ELECTRICAL REVIEW

ILLUSTRATED.

A WEEKLY JOURNAL OF

Electric Light, Power, Telephone, Telegraph and Scientific Progress.

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VIEWS, NEWS AND INTERVIEWS.

The recent accident on the Brooklyn Bath Beach and Bensonhurst Electric Railroad, by which four people were injured and kegs of beer to the amount of three tons were spilled upon the street, will have a salutary effect upon the proud and czar like truck-driver. The undisputed right-of-way which the cable cars at Chicago and other cities enjoy, was only obtained after several such lessons. While it is regretable that the motor man and two passengers were injured, it is some satisfaction to know that the driver of the beer truck attained the same experience. He was the person the lesson was intended to reach.

Again the wayward district telegraph messenger has got himself into trouble. One of the New York genus stopped by the wayside the other day to observe the result of a chemical experiment which was being tried on a curbstone by a youthful scientific investigator. An explosion ensued, but owing to the messenger's habits of sloth, he was unable to get out of the way before his trousers caught fire. This burning question was solved by the application of the messenger's coat to the flames. Thus, we see, that the investigator of the truths of concrete science often attains results interesting alike to himself and his audience.

A wild and hirsuty Texan was arrested and convicted at Longview, Tex., for using the insulators on the telegraph poles as targets for pistol practice. This is sad, because Texas has no superfluous advantages and it is harrowing to realize that her own citizens do not appreciate such progressive improvements as the telegraph.

This occurrence recalls the anecdote related of the Governor of North Carolina and the Governor of South Carolina, who made a pilgrimage through the Lone Star State during one of the intervals alluded to in a world famous anecdote.

"Texas has good farms, fine vegetables, beautiful scenery and many other advantages," said he of the South.

"Yes, but Texas lacks good water and good society," replied he of the North.

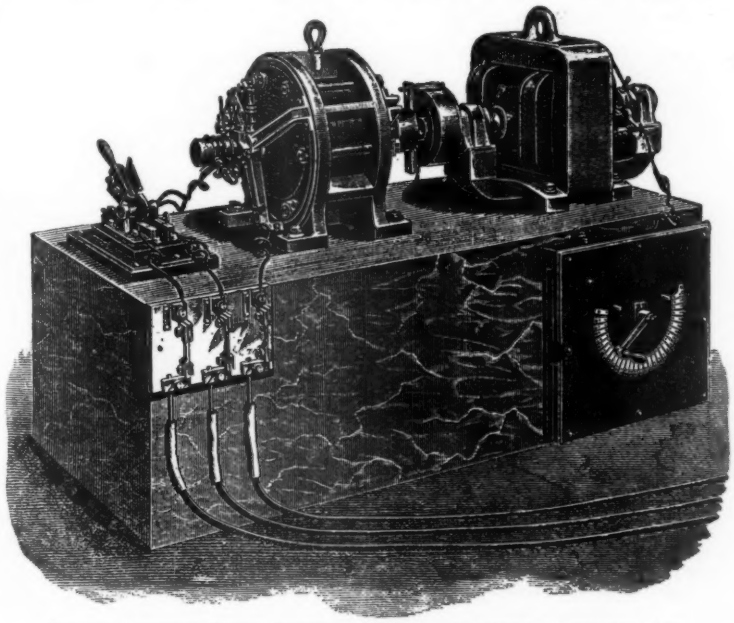
"Toobysure," retorted he of the South. "That's all that h—l lacks."

"Search-lights can be put to bad uses, just like everything else," said a pilot on one of the big Sound steamers. "Two boats belonging to rival lines were running a little race one night not long ago. The smaller of the two happened to be the speedier and was winning the race, when an officer of the larger boat turned the current on his search-light, and trained it so that its powerful rays fell upon the pilot house of his little rival. Of course, the pilots were blinded by the glare, and couldn't see to steer. The result was that the leading boat had to lay-to until the other got by and so far away that the search-light became harmless."

The weather prophets are almost unanimous in predicting a long and severe winter. Electric light and power companies who contemplate out-door construction work will do well to heed a timely warning and rush matters while the sun shines.

Rotary Current Motor.

In the accompanying engraving is illustrated a two horse-power Dobrowolsky rotary current motor driving a continuous current dynamo, being a copy of a part of an exhibition plant of the rotary current system at the Frankfort Exhibition. The principle of the rotary current system, recently described in the ELECTRICAL REVIEW, is a rotation of magnetism through an annular iron core by the co-operation of a three-phase alternating current so overlapping as to cause a continuous rotary travel of magnetic poles through the ring, thus creating a continuous pull on the armature. The exhibition plant comprises two motors, the first being a one tenth horse power motor driving a ventilating fan, and the second a two horse-power motor which will take a load of four horse-power without perceptibly slowing down. It runs normally at a speed of 18 revolutions per minute. The driving current is supplied from a machine driven by a continuous current supplied from an Oerlikon dynamo. Directly coupled to the alternating motor is a continuous current dynamo, illustrated in the engraving, running a number of incandescent lamps.



ROTARY CURRENT MOTOR DRIVING CONTINUOUS CURRENT DYNAMO—TWO HORSE-POWER DOBROWOLSKY.

Blasting by Electricity.

A method of blasting by electricity has been tried in Sweden with good results. The means consist of a voltaic arc produced between two carbon rods placed parallel. When the arc is moved close to the spot to be blasted an intense local heat is created, resulting in expansion, that splits the rock.

The Fort Wayne Electric Company has received orders for arc apparatus to the extent of 7,000 lights since January 1 of this year. This is believed to be in excess of orders received by all other electric companies in this country outside of the Thomson-Houston.

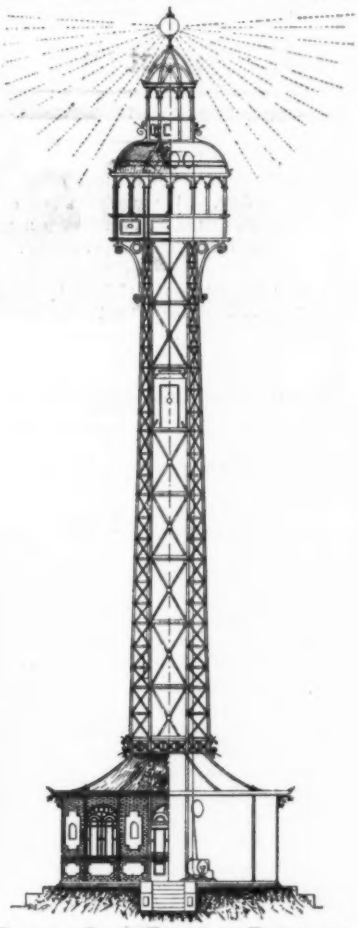
The Iron Tower at the Frankfort Exhibition.

One of the attractive features of this exhibition to the general public, and from an engineering point of view, says London *Engineering*, is the iron tower just built by the firm of Messrs. E. de la Sauce and Kloss, of Berlin, and certainly one of the greatest novelties of the exhibition is the electrical elevator, which is daily carrying passengers to the top of this tower, from which a very fine view is obtained of the city of Frankfort and the surrounding country. The Otis electrical elevator contained in the tower is designed to lift a load of from eight to ten people, and is running daily at a speed of about 240 feet per minute, stopping and starting with a motion in every respect equal to the best type of hydraulic elevator. The machine has recently been passed by the German police authorities, whose laws are known to be very particular in relation to the safety of elevators, and who did not permit the introduction of suspended types of hydraulic elevators into Germany until long after they were introduced into this country. The electrical elevator is worked by a lever in the car, avoiding altogether the use of the hand rope, which, for passenger service, is sometimes found objectionable where it is desired to operate the machine by dainty hands.

The tower is entirely of wrought iron, and has a height of 139 feet 9 inches. It consists of four principal columns, which form a square of 5 feet 2 inches, which space is utilized for the elevator car. The cross section of either column forms a triangle. The sides of this triangle at the bottom of the tower are 46 inches, and at the top platform 15.75 inches in length. Thus the structure at the bottom is 13 feet 1 inch square and at the top 7 feet 10 inches square. The inner corner of every column consists of I iron, angle iron having been used for the corners. Horizontal ties are used at distances of 39 inches, and corresponding diagonals of flat iron combine every three pieces to one column. These four columns are joined together at distances of 10 feet by horizontal trellis frames, which, built in this way, are considered to give a specially firm system. To the inner I iron corners of each column are attached the guides for the lift, and on the outer side two of these I irons serve as guides for the counterbalance weights, which run in hollow columns. These hollow columns serve also for the cables which pass from the machine room to the top of the tower and down to the car, where they are attached on the regular Otis system.

The foundation of the tower consists of a plate 19.7 inches deep and 32 feet nine inches square, upon which the iron foundation frame of the tower is fixed to the shaft, the whole serving as a ballast to prevent the tower from shaking. At a height of 105 feet there is an octagonal platform, having a diameter of 16 feet, six inches. Upon this platform there is room for 30 persons. It is covered with a dome-shaped roof, above which there is a second platform, in the dome of which is fixed a large electric light. This second platform is 121 feet five inches above the ground, and contains a reflector. The building at the base of the tower is used as a tea-room, a small portion only being used for the hoisting machinery, and is 32 feet 9 inches. The walls of the building are of ironwork, filled out with plaster; windows are provided with colored glass. The entrances to the lift and platforms are shut by Bostwick gates, which are well suited to this purpose, as they are not in the way when being opened or closed. The car is about five feet square, but in this space it is only permitted by the authorities to carry six persons. The sides and lower part of the tower are lighted in the evening with 600 lamps.

The electric current for the elevator is supplied from a distance of about 200 yards, by the firm of Schwartzkopff, of Berlin. The reflector, which has a diameter of about one metre and a power of 10,000 candles, has been supplied by Siemens & Halske.



ELECTRIC LIGHT TOWER AT FRANKFORT.

THE PROPHET'S COLUMN.

Many years ago there was exhibited in Europe an apparatus known as Faber's Talking Machine, which was a most complex piece of mechanism, imitating as nearly as possible the organs of the human voice. It had a complicated keyboard, capable of various adjustments, and a bellows representing the lungs. As might be expected, the speech produced by this machine was very imperfect, and but faintly resembled the human voice. It is now of interest only as a mechanical curiosity.

When the phonograph was invented it was naturally compared with the existing talking machine, and the wonderful simplicity of the former was strongly brought out by the contrast. The comparison was unfair, however, for Faber's machine was an attempt to originate speech, while the phonograph only reproduces speech, which is quite a different matter.

The phonograph, and by that is meant the machine under its various forms and names, has, up to the present, served as a valuable apparatus for the analysis of sound, but it doesn't seem to have occurred to any one that in the synthesis or putting together of sounds it is capable of producing supremely wonderful results.

The vibratory nature of sound is well known to students of physics, and it is a matter of common knowledge that the pitch of a musical note depends upon the number of vibrations per second which produce it; but it is not so well known what constitutes the difference between the tone of a violin and of a flute, both sounding a note of the same pitch, that is, having the same number of fundamental vibrations per second.

This difference is explained by the fact that the violin string not only vibrates as a whole, producing its fundamental note, but also in its different parts, producing a number of very rapid vibrations which blend with the fundamental and impart to it its peculiar quality of timbre. These extra vibrations are called overtones or harmonics, and it is their presence in a different degree which distinguishes the sound of the flute from that of the violin; or which makes a voice loving, persuasive and sympathetic, or hard, rasping and disagreeable. Were it not for the harmonics, music would be insipid and unpleasant. A tuning fork produces such a tone. It is quite free from harmonics and has pitch only, being noticeably devoid of quality. By means of a number of tuning forks, however, so vibrated as to produce the overtones in proper relation to the fundamental, almost any musical instrument may be imitated. This is the synthesis of sound. A phonographic record of a pure tone would be a sinusoidal curve, but a tone having quality would show the overtones indented upon the sinusoidal curve, producing the ragged lines seen in the pictures so commonly used to illustrate this point in works on acoustics.

In the ordinary usage of the phonograph, or the gramophone, which is better for this illustration, as its record is in the form of curves on a flat disc, the record is made by the voice, but if by any other means the sound curves could be enlarged upon the disc, the machine would reproduce the sounds just as faithfully.

Thus, if all of the tuning forks in the world were destroyed, never to be used again, Emile Berliner, by etching a sinusoidal curve upon his gramophone disc, could, in less than a week, restore to the world its concert pitch.

It would be quite within his powers to cause to be engraved upon the disc a series of curves, which would reproduce any simple tune as though it were played upon tuning forks, that is, giving differences of pitch only. Having thus produced the skeleton tune, it would only require an extended series of observations of the timbre curves of the cornet, for example, to impart to the record the quality of that instrument.

If this can be done with the cornet, it would, of course, be possible with any other instrument or combination of instruments. It would even be possible to produce the tones of the human voice itself in this way. The characteristic curves of any given voice being determined, it would be possible to cause the machine to utter the lines of any speech or the melody of any song in the tones of that voice.

If all of the musical instruments in existence should be eternally wiped out, and all men should suddenly be struck dumb, modern science, with the phonograph, could supply the world with music, and mankind with speech and song.

Although the theoretical possibility of such a result is beyond dispute, yet the practical difficulties in the way of such a prodigious accomplishment are almost appalling. While the existence of all but insuperable obstacles must be admitted, it should be borne in mind that they are mainly mechanical, and that the resources of science are infinite. The first step toward any scientific attainment is to show its theoretical possibility. In this case this has now been done, and hundreds of plans of practical procedure are looming up to mind.

Mere manual dexterity will not form a necessary part of the musical science of the future. A symphony will some day be expressed in mathematical formulæ, but science can never furnish the soul for music or invade the domain of creative intellect.

THE PROPHET.

The Gulcher Thermal Battery.

With a view to improvement of the thermal battery, R. J. Gulcher, a German investigator, has applied himself to the task of finding better heat resisting materials, raising the E. M. F. and increasing the efficiency.

Subsulphide of copper, in spite of its high electromotive force, gave, on account of its high specific resistance, a weaker current than materials which gave only half its electromotive force, and it was also found that, by a species of dry electrolysis, granules of metallic copper were formed throughout the body of the material, and its use was, therefore, discarded. One form of battery was tried which consisted of tubes of nickel and a special antimonial alloy, which was found to be very durable; this consisted of 50 elements in series united in one casing; and gave an electromotive force of 3.5 volts, and an internal resistance, when hot, of 0.4 ohm, with a consumption of 7¼ cubic feet of gas per hour, and the absolute efficiency is 1.08 per cent., or three times that of the existing thermo batteries. Such a battery is almost equivalent to two Bunsen elements, and though it is far below the dynamo in efficiency, still it may be suitable for various small installations and for experimental work, owing to complete absence of polarization, as the electromotive force does not fall on short circuit. The durability is enhanced by a regulator applied to the gas supply to prevent any accidental overheating.

The Gamewell Company at Montreal.

The widely-known Gamewell Fire Alarm Company will be represented at the Montreal Electric Light Convention this week by Major Frank C. Mason, the Brooklyn official and electrical engineer. President J. W. Stover, of the Gamewell Company, never does things by halves, and, in being able to secure the assistance of an artist of the ability and weight of Major Mason to represent his company for the first time at a national convention of electric light interests, is to be congratulated. Conventionites who never heard of the Gamewell Company will hear of it now, and its fame and the good qualities of its system will go out over this broad land as never before. Major Mason's headquarters will be all over the exhibition grounds (he will be known by his uniform) and he will be glad to hand you his Gamewell card if you will only ask for it.

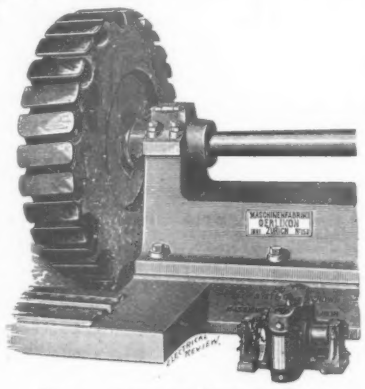


FIG. 2.—VIEW OF MOVABLE PART.

An Electrical Lawyer.

Johnny Wise, originally of Virginia, and son of an ex-Governor of the Old Dominion, is making a fortune right in the heart of Wall street. In stocks? Oh, no. He is a lawyer, and was down at the heels several years ago. The great electrical corporations loomed upon the horizon. Their securities were listed on the New York Stock Exchange. Tangles came. There were 20 renowned lawyers in Wall street, with Edward Lauterbach at their head, familiar with every wrinkle of corporate law as applied to trusts and allied industrial enterprises. But where was the lawyer who knew the first rudiments of law as applied to electricity and electrical corporations? Not one. But up popped Johnny Wise. In a day he changed the pleasant habits of his life inherited from generous Southern hospitality. Every scrap of law in this or any other State or Territory in the Union, bearing on electrical companies, was conned day and night by Wise. He gained, furthermore, practical knowledge of the business. He made himself a mechanic. He visited Edison's shops at Menlo Park. He visited all other shops. He worked like a Trojan. His fees now round up $60,000 a year. A great inventor cannot always defend breaches upon his patents. He may talk electricity and patents until he is blue, and a jury, from sheer discouragement at understanding anything about the case, would give any verdict that their worn-out sensibilities demanded. Wise stands before these juries and makes electricity and electrical corporations novelettes to them.—*New York Truth.*

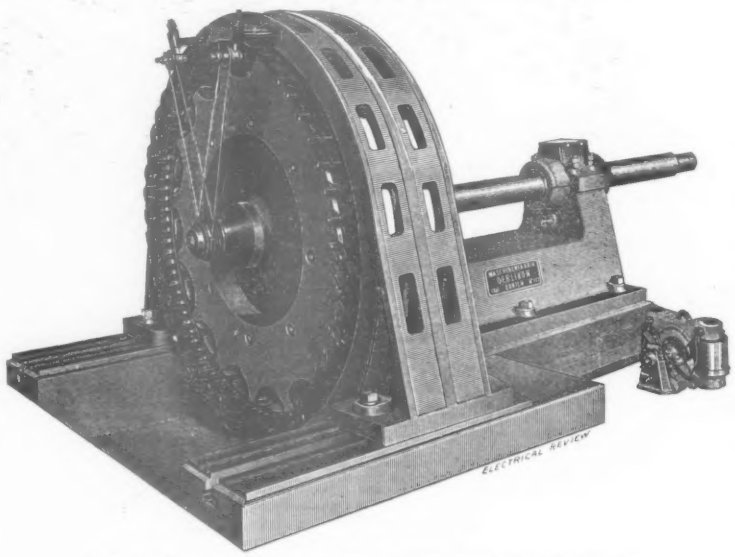


FIG. 1.—BROWN'S "MULTIPHASER" DYNAMO—OERLIKON WORKS.

The Oerlikon Three-Phase Alternator.

The Oerlikon works, which have for long made a specialty of transmission of power installations, are about to lay down several plants on the multiphase system devised by Mr. C. E. L. Brown. For the following description we are indebted to the London *Electrician:*

In Fig. 1 we have a general view of a 300 horse-power Brown "multiphaser," running at 150 revolutions. The armature circuits are arranged to give three alternating currents, lagging 120 degrees, one behind the other. Each of the three circuits of the machine is wound for a pressure of 50 volts and a current of 1,400 amperes. The current output being large, rubbing contacts have been avoided by making the armature stationary and the field magnets revolve. The armature conductors are 29mm. in diameter, and consist of massive bars of copper, insulated inside asbestos tubes, and buried in holes punched out of the iron close to the internal periphery. Foucault currents, which would attain enormous values in such large copper conductors, if they were arranged in the ordinary way, are by this device avoided; in fact, experiments made with "buried" conductors, 50mm. in diameter, did not show that any power was lost by Foucault currents. This method of arranging the armature conductors is mechanically strong, and, as it enables asbestos to be used as an insulator, results in an armature which is absolutely incombustible. Moreover, the reduction in the air space, and the consequent improvement of the magnetic circuit, reduces the exciting current.

Corresponding to the 32 poles of the field-magnet, each circuit of the armature has 32 copper bars, connected in series by transverse pieces. There are, therefore, in all, 96 (3x32) bars on the armature. The three circuits are joined up to each other in a manner similar to the three circuits of the Thomson-Houston arc machine. The armature core is surrounded by a cast-iron frame, and the whole can be moved along the bed-plate for cleaning and other purposes, leaving the field-magnet open to view, as shown in Fig. 2.

The exciting circuit is coiled round a sort of cast-iron pulley. Two steel rims, each armed with 16 horns, forming pole-pieces, are bolted on to the pulley, one on either face, in the manner shown in detail in Figs. 3 and 4. This arrangement permits of the maximum utilization of the magnetic flux, and both the copper and the exciting current are reduced to a minimum. The construction of a field-magnet of this type is very simple, the 32 pole magnet being only in four separate parts, an inestimable advantage in a piece of moving mechanism subject to heavy stresses.

The exciting current is taken to the field magnets by means of two metallic bands, each of which passes round a grooved ring on the spindle and round a pulley connected to a terminal. (See Fig. 1.) The armature is overhung, the massive spindle being carried on a double bracket bolted to the bed plate.

A machine of this type can work equally well as a synchronizing motor, but it differs from an ordinary alternate current motor, inasmuch as it can be made to start without difficulty.

A few figures may not be without interest. The total weight of copper on the field magnet is 300 kilogrammes; that is to say, a fraction of the copper usually required for other machines of the same size. To excite the machine so as to give 50 volts on open circuit only 100 watts are required; that is to say, one twentieth per cent. of the output. At full load, owing to the reaction of the armature, this amount is slightly increased, but it never exceeds a fraction of one per cent. At full speed and with normal volts the friction losses amount to 3,600 watts. Total weight of machines, without bed-plate, is 9,000 kilogrammes.

The Lauffen-Frankfort dynamo is of the above type, and has successfully done the work it was expected to do.

The Edison Electric Company has just contracted to put in a $30,000 plant at Ishpeming, Minn.

Arc Lamp Manufacture.

THE GROWTH OF THIS BRANCH OF THE ELECTRICAL INDUSTRY—THE WORK OF A PROGRESSIVE COMPANY.

The great arc light factories of the Thomson-Houston, Brush, Fort Wayne and other large concerns have long been recognized as strong factors in the progress of electric

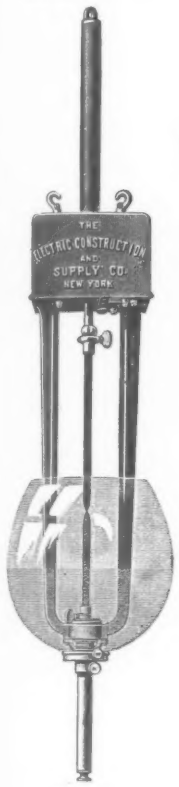


FIG. 1.

FIG. 2.

FIG. 1.—WARD ARC LAMP, NO. 1.
FIG. 2.—WARD LAMP AND CHIMNEY COIL.

lighting, and the improvements that have been made by the bright minds in the employ of the different corporations are incalculable. To-day there are probably a quarter of a million arc lamps in use in the United States, and this number is constantly increasing.

The beautiful and graceful incandescent lamp has extended its sway in like proportions as has the arc lamp; and the estimate is made, and probably very nearly correct, that there are 5,000,000 of these glow lamps in use in this country at the present time. The unionizing of the arc and incandescent current was a thing devoutly to be wished for, and this union is now one of the beautiful and practical things in the world of illumination.

The earliest, we believe, to enter this field and endeavor to furnish an arc lamp that could be successfully used on incandescent circuits was the Electric Construction and Supply Company, now of 18 Cortlandt street, New York city. This company was organized in 1881 and incorporated in 1883, and after a few changes of management, came under the control of the present progressive and successful business men, Mr. Herbert Torrey, president, and Mr. R. B. Corey, general manager.

These gentlemen, realizing that they had a good thing in the "Ward" arc lamp, by which arc and incandescent lamps could be combined, and possessing the faith that every successful man should have in his own enterprise, have energetically and earnestly brought this lamp to the attention of the electrical companies of the country, and are now reaping the benefit of their hard and intelligent work. In this case the old adage that "If you have a good thing it will pay to let the public know it," has proven to be the whole truth, and the "Ward" lamp is now known far and near, and is popular wherever it is known.

It is in no perfunctory sense that the REVIEW chronicles the success of this company and its lamp, and in this issue illustrates the various styles of its manufacture. Such companies as these assist most ably in the advancement of the scientific as well as the commercial and practical side of the industry, and the Electric Construction and Supply Company deserves more than a passing notice for the good work it has done.

To-day it is manufacturing six special arc lamps, all of the "Ward" patent, including the search lamp, railway lamp, theatrical lamp, alternating lamp and photo-engraving lamp. The company has just issued a handsome catalogue, comprehensively illustrated, and possessing, in its text, literary merit to an unusual degree. The contents of the catalogue are so arranged as to graphically and interestingly tell their story right off, and in whichever branch you may desire information, you can get it in convenient form. The catalogue contains a number of testimonials complimenting the "Ward" lamp in a manner that gives the manufacturers every reason to be proud of their ability to win them.

FIG. 3.—WARD LAMP AND HOOD.

FIG. 5.—WARD THEATRICAL LAMP AND COLOR BOX.

FIG. 6.—SAME, WITH LENS BOX.

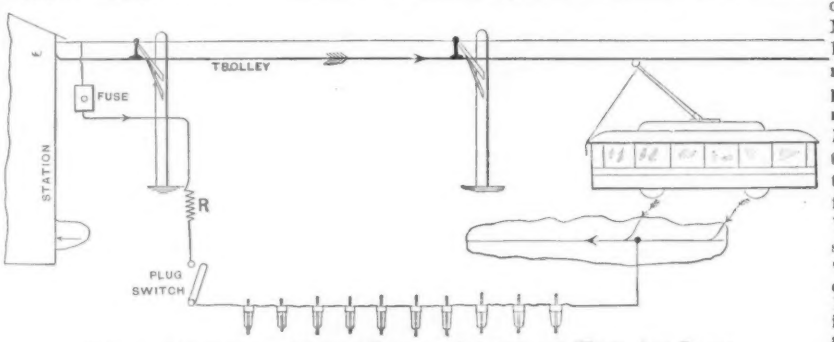


FIG. 4.—DIAGRAM OF ELECTRIC RAILWAY CIRCUIT AND WARD ARC LAMPS.

A Wise Western Opinion of the "Electrical Review."

TO THE EDITOR OF ELECTRICAL REVIEW:

Appreciation of effort is an encouragement to go on and, if possible, do better. Permit me to express my opinion—which may not be any more than a drop in the bucket—of the REVIEW, issue of August 22.

Owing to the Summer absence of certain members of my household I have had more time at my disposal for reading the various electrical journals, and it affords me pleasure to state, putting myself in the position of a buyer, operator, investor in electrical interests and advertiser, that your journal contains more varied information than that of any other paper published in the same week.

The subjects, paragraphically treated, were so far-reaching and covered so many departments of the electrical interests, it would require too much time to go into detail of their respective merits.

While not a direct advertiser in the REVIEW, but directly interested in companies who do, my judgment would be that a paper containing matter which is of sufficient interest to secure the attention of the reader, must also be the medium for me to secure his attention to my advertising. "READER."

Chicago, August 27, 1891.

The Board of Control.

The Board of Electrical Control met Wednesday of last week. Among those present were R. R. Bowker, of the Edison Company; Paul D. Cravath, of the Westinghouse System; Vice-President Ridgeway and Lawyer Cohen, of the Consolidated Subway Company; ex-Assistant District-Attorney Porter, of the Mount Morris Company; General Manager Brown, of the United Light and Power Company; General Manager Leslie, of the Manhattan Company, and Messrs. Kearney and Wheeler, the Board experts. The Edison Illuminating Company had applied for permission to lay conduits in a number of streets, but at the meeting Mayor Grant claimed that a list of these streets, previously submitted to him, did not tally with the list furnished the Department of Public Works, upon which permits for street openings were to be issued. The latter list was longer and included streets already repaved. The Mayor thought that there was an intention to deceive, and he stormed at R. R. Bowker, who was present as the Edison Company's representative.

When Mr. Bowker commenced to explain, the Mayor interrupted him with:

"You told me that everything you wanted was on the original application, and now we find it is not. What was the use of calling a meeting under such circumstances? Did you do it for fun?"

The Mayor then moved that the whole matter be laid over, and this was done, despite Mr. Bowker's protest that such action would delay the repaving of Broadway.

Circleville, O.—Electric Light Company; capital, $100,000.

Jersey City, N. J.—The American Light and Fuel Company, recently organized, announces that the capital stock of the concern, $20,000, has been paid in.

East St. Louis, Ill.—The Waterloo Electric Light and Power Company; capital, $10,000. Incorporators: William Murdoch, R. M. Hammon and M. A. Waters.

Portland, Me.—The Jenney Star Electric Company; capital, $50,000. The officers are: President, James A. Jenney, Fairhaven, Mass.; treasurer, Albert W. Rounds, Boston, Mass.

Portland, Conn.—The capital stock of the newly organized Portland Electric Light Company is $60,000, and the entire amount has been subscribed for, mostly by residents of the town.

Ironton, Cal.—Articles of incorporation have been filed with the Secretary of State, of the Ironton Water, Light and Power Company; capitalized at $50,000. The incorporators are: Lieutenant-Governor Story, J. N. Casanova and Josiah Winchester, of Ouray County.

Roanoke, Va.—The charter of the Roanoke Electric Construction Company has been granted and they start with a minimum capital of $50,000, with power to increase it to $300,000, in shares of $100 each. The officers for the ensuing year are: President, E. W. Clark, Jr., of Philadelphia; vice-president, Stephen E. Haas, of Chester, Pa.; secretary and treasurer, Chas. A. Pearson, Jr., of Philadelphia. The directors are: Harna W. Sellers, C. A. Pearson, A. C. Denniston, E. W. Clark, Jr., of Philadelphia, and S. A. Haas, of Chester, Pa.

Copper.

It is authoritatively stated that for the 12 months ending June 30, 1891, the total exports of copper from this country amounted to 34,500,000 pounds, as against 20,200,000 pounds for the 12 months ending June 30, 1890. The improvement in the general copper manufacturing business and in the electrical business is causing a renewed demand for copper, especially the lake brand. This, in connection with the strong statistical position of the metal, is responsible, says the *News Bureau*, Boston, for the buoyancy in copper mining shares.

Electric Welding Commercially Considered.

The London Contract Company has made a payment of £5,000 to the European Electric Welding Company for the purchase of its English rights, and which was not due until September 1, says the Boston *News Bureau* of August 29. The balance of the purchase money, £20,000, is due November 1, but may be paid October 1.

The European Electric Welding Company has received, including the above payment, £90,000 from the English syndicate, of which £80,000 was for the patent rights for Great Britain and £10,000 forfeit money for Continental rights.

The English company has bought out its prospectus and subscriptions close to-day. Capital stock is £2,300,000, par $50. It comprises 45,000 ordinary shares and 10,000 founders' shares, of which the European Electric Welding Company receives 8,333 ordinary and 400 founders' shares, besides $527,795 cash. One million capital stock and $242,695 cash are to be put in the treasury for working capital.

Options maturing September 1 have been extended to October 1 for electric welding rights in Germany. Austria-Hungary, Russia, Scandinavia, Denmark, Belgium and Switzerland, on terms similar to the English terms.

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NEW YORK, SEPT. 12, 1891.

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To the Knights of Electric Light at Montreal: The ELECTRICAL REVIEW greets you most cordially.

It would seem that Ferranti's experiment at Deptford, near London, is a failure. The immense dynamo remains uncompleted and the stockholders of the company refuse further financial assistance.

Our esteemed and sometimes erratic contemporary, *Electrical Enterprise*, announces a change of management with the statement that it is following out the text of its first editorial, "the survival of the fittest," and Prof. Frank M. Gilley steps to the front as editor. This is all very well, but what is the use of giving the retiring member of the staff such a decided kick?

THE MONTREAL CONVENTION.

The Convention of electric lighting men, held at Montreal this week, will doubtless lead to increased development of the great industry they represent.

When we reflect that the phenomenal growth of this industry has occupied but a single decade, and that there are now in active commercial use in the United States alone about 5,000,000 incandescent lamps and 250,000 arc lamps, we marvel at the rapidity of its development and its promise of future greatness.

The time is rapidly approaching when all other illuminants will be relegated to desuetude and figure only on the pages of history.

With the assurance which has lately reached us, that power may be transmitted over a distance of more than 100 miles with a slender wire as the only conduit for the energy, we can safely pin our faith to the electric light as the future universal source of illumination.

The gigantic progress made in this art is due largely to the enterprise of the gentlemen who will meet at Montreal. They are picked men—the flower of the industrial flock on this continent. The electrical field has presented such a fruitful harvest of successful results in all industrial lines that it has attracted the brightest intellects and most progressive minds.

Stimulated by past and present successes, its votaries will explore its every possibility. Inventor and capitalist are eager in pursuit of improved methods and apparatus by which more efficient and more economical results may be attained. Both will be rewarded, not only with the plaudits, but with more substantial evidences of the gratitude of an appreciative public.

It was under the instructions of the late Admiral Porter that Lieutenant Cushing made his famous raid on the confederate ram Albemarle. All the circumstances of this famous naval exploit are detailed in a letter written by Admiral Porter, which appears in the September number of the *North American Review*.

If any one is still of the opinion that the electrical industry is depressed, we invite their attention to the ELECTRICAL REVIEW this week. Read every page—the picturesque and persuasive advertising pages as well as the many solid columns of newsy, practical and scientific matter—and you will be instructed and edified, and convinced that the electrical people are more progressive and energetic than ever, after the rest that naturally accompanies the heated term.

Mr. R. B. Owens, formerly manager of the electric light company at Greenwich, Conn., and an educated electrical engineer, goes to the University of Nebraska, at Lincoln, to assume responsible duties with that well established educational institution. Professor Owens will specially devote himself to electrical work, a department for which by experience and education he is well fitted.

While the phonograph is of undoubted value in the study and comparison of the music and language of savage nations, its use in unskilled hands is apt to produce misleading results. A correspondent of the New York *Tribune*, in a letter which we publish elsewhere in our columns, shows how, in one case at least, an irregularity in the speed of the electric motor has lead to false deductions. It would seem that certain delicate intonations noticed in a phonographic record of Zuni Indian music, which suggested that the Zunians might be the musical first cousins of the Hindoos, Arabs and ancient Greeks, have now been accounted for by the irregular speed of the phonograph cylinder.

ELECTRICAL KNOWLEDGE ONE HUNDRED AND FIFTY YEARS AGO.

A CONTRIBUTION TO THE HISTORY OF THE LEYDEN JAR, ETC., BY P. H. VAN DER WEYDE.

The Leyden jar, by which static electricity can be accumulated and made to produce violent shocks, in place of merely stitching sparks, was, as is well known, first invented in 1745 by Kleist in Camin Pommern, Germany, while in the following year, 1746, Cuneus, the assistant of Prof. Petrus Van Musschenbroek, in Leyden, Holland, without knowing anything of the invention of Kleist, produced a similar contrivance. After having experienced the violent shocks it could produce, he tried it on the old dignified professor, who was so utterly amazed, upset and frightened by this new experience, that he wanted to be brought to bed, and took medicine, fearing, as he did, the most serious consequences. He recovered, however, without being any the worse for it, but he said openly that for the whole kingdom of France he would never again receive such a commotion.

The Leyden jar of that time consisted simply of a Florentine flask, which is a globular bottle with a long narrow neck, in which the wine (Chianti) comes from Italy. It used to be made of very thin and hard glass, but since the last few years it has lost the qualities which made it so valuable to the electrician and to the chemist. It is now manufactured of much thicker glass, which makes it no more adapted to receive such very strong electric charges as it used to bear before, while the glass itself has no more the excellent insulating qualities, being less hard and more easily fusible, to which the chemists object, as well as to the much greater thickness, which makes it more subject to crack over the fire.

Only some 10 years ago the flasks of Chianti, imported from Italy, were made up in the old way adopted long before the use of corks was known. In order to exclude the air, a little olive oil was poured in the long neck, on the top of the wine, and a small plug of straw placed above to exclude dust. So the wine could discharge gaseous products, and no remnants of fermentation could burst the bottle, as is occasionally the case with cork sealing. The bottles could, therefore, be very thin, being never subject to any pressure, but as a matter of course could not be turned over, and were, therefore, packed in boxes of such a shape as to secure the upright position during transportation. This is, however, all done away with now, and recently I found it impossible to obtain in all New York a single bottle of Chianti preserved in a thin old-fashioned hard glass Florentine flask; what I obtained was far inferior for electrical purposes, and did not compare in its effects with what I was accustomed to 40 years ago. Still, it is better than much of the so-called flint glass now in the trade, which is very easily fusible and soft, while by the excess of lead some of it has such deficient insulating qualities as to be totally unfit for experiments of the Leyden jar class.

The original form of Leyden jar, as used by Cuneus and with which he amazed the old professor, consisted simply in such a Florentine flask half filled with water, and a brass rod passed through the neck into the water; this served for the inner coating, while the stretched-out hand placed under the flask, supporting it, formed the outer coating.

At present, tinfoil is used for outer and inner coating; it is simply pasted on, and when the neck is too narrow to introduce the hand, some conducting scraps, such as brass filings or turnings or shot, are placed inside. This would, however, make large jars too heavy; in this case the jar is interiorly coated with some varnish, of which a sufficient but small quantity is introduced, and the jar turned round to distribute it evenly; and, finally, metallic filings or small chips of tin-leaf, etc., are made to stick around as far as the varnish has been allowed to distribute itself.

Ten years before the invention of the Leyden jar, Jan van Musschenbrock, a brother of the professor, published an illustrated description of improved air pumps and other philosophical apparatus, of which he was the manufacturer, and also devotes some 70 quarto pages to a description of 72 different experiments which can be made with them, giving also comments on every experiment.

At the close he gives a price list of what he has on hand in his Leyden establishment, from which, for curiosity sake, I select the description of a few pieces, evidently intended for electric demonstration, which, however, he appears not to acknowledge, as he intentionally ignores the word Electricity.

EXTRACT FROM PRICE LIST OF APPARATUS ON HAND AT THE ESTABLISHMENT OF JAN VAN MUSSCHENBROCK, MANUFACTURER OF PHILOSOPHICAL, MATHEMATICAL AND SURGICAL INSTRUMENTS, PRINTED IN LEYDEN, 1735.

1. A globe of glass and a turning lathe, by which this globe can be rapidly rotated; when thus the hand is placed against the rotating globe so as to produce friction, many remarkable phenomena of attraction, and repulsion of neighboring light bodies can be observed.....36 gülders.*

2. Two such globes placed one near the other and rotated by a large turning lathe, exhibiting many other remarkable phenomena.....75 gülders.

3. A glass tube, which when rubbed exhibits wonderful attractive and repulsive powers.....2 gülders.

4. A frame work with wheel by which a body can be very rapidly revolved inside a glass globe, while it rubs against another body, it will exhibit luminosity..60 gülders.

5. A double exhaust air pump by which the air can be removed from glass vessels.....300 gülders.

When with this air pump the above glass vessels have previously been exhausted from air, they all will show bright luminous effects when rubbed.

The above-mentioned price list is illustrated with four excellent copperplate engravings, representing some 40 figures of the apparatus described.

About the same time that this price list was published, Prof. Petrus von Musschenbroek published a translation of his Latin text-book on physics in two large quarto volumes of some 1,000 pages, also illustrated with copperplate engravings, 29 in number and containing some 500 figures. A remarkable fact is that the chapter on electricity occupies only 18 pages of the 1,000, which shows how, at that time, little was known of the science which now, by its gigantic development, overshadows all other branches. However, he refers to the investigations of Gray and DuFay, but says: "I can, in this little book, not describe all what these philosophers have discovered, wherefore I will only describe the wonderful phenomena obtained by the friction of a revolving glass globe or of a glass tube rubbed by the hand." He explains further the two kinds of electricity and the mutual attraction and repulsion, and speculates on the theory that there must be a molecular rotation involved, but expresses the suggestion that it is very difficult to conceive how such rotations can be transmitted rapidly along a wet rope 1,265 feet long; he asks, What is its velocity? Why does the electricity go easily through a solid wire, while it will not go through other substances which are very porous? And he says in conclusion:

"To all these and other questions at present no answer can be given; many experiments will have to be made with the purpose to solve such problems, during which experiments many other mysterious phenomena will no doubt be discovered of which, at present, we have not the least conception."

We are happy to live at a time to see this prophesy of the old Professor (made more than 150 years ago) fulfilled not only, but we become convinced that the end is not yet. Not only this, but we are driven to the conviction that the end is at an infinite distance. The love for research which animates the best of our race will keep them on the highway to further research, which in place of simplifying theories, will, while solving one problem, present others far more complex and mysterious. The physicist will become like the astronomer who, with the most powerful telescope, can find no end in the depths of space, so the searcher for the ultimate and peculiar molecular motions, which we call electricity, will become more and more absorbed in the contemplation of the infinite complexity which lays at the foundation of phenomena, of which the laws are simple enough to formulate, and easy enough to understand and remember, but of which the ultimate cause is the *ignis fatuus* of human understanding.

* The Holland gülder is equal to 10 cents United States currency, it has the weight of 10 grammes of the metrical system and is the standard of value, while go'd is variable, according to the relative value of both metals governed by the laws of supply and demand.

OUR LONDON LETTER.

INTERESTING MENTION OF ELECTRICAL WORK ABROAD—NEW LIGHTING AND RAILWAY PLANTS — LONDON-PARIS TELEPHONE — SUCCESSFUL POWER INSTALLATION AT FRANKFORT.

Cologne.—A large central station for the supply of 18,000 lamps in Cologne is expected to be ready for working within the next month.

Aluminum.—It is now proposed to use aluminum in place of magnesium for photographic flash-lights. Chlorate of potash mixed with powdered aluminum produces a brilliant flash without the smoke produced by the magnesium.

Ambleside Electric Lighting.—The electric boat owners on Lake Windermere have prepared estimates for the lighting of Ambleside with electricity. The installation would cost $2,000 and the working expenses be ten per cent. per annum. The matter is under the consideration of the local board for their next meeting.

New Anglo-German Cable.—The first messages over the new wires were dispatched to the Emperor William and to Queen Victoria. Messages were also exchanged between Dr. von Stephan, the German postmaster-general, and the postmaster-general here, Mr. Raikes. The death of the latter at the early age of 53 years was announced yesterday.

Electric Pumps.—The Thomson-Houston Company advise that they are now making electric pumps for supplying water in buildings with motor and force pump, the motor being automatically arranged to stop when the tank has been filled and to start again before it is quite empty. The pumps used are Gould triplex, having a capacity of 100 gallons an hour, raised 30 feet high, run with a one-quarter horse-power motor off the town electric mains.

The Liverpool Overhead Railway.—The directors' report shows most satisfactory progress during the past half year. The main structure is erected as far as the Collingwood Dock; Stanley Dock opening bridge is completed and the accommodation works on the northern section are well advanced. The chairman, Sir W. Forwood, in presiding at the annual meeting, stated that a contract for the equipment and working of the line by electricity had been concluded with the Electric Construction Corporation (Limited), of London and Wolverhampton. Within the last six months two miles of the line have been completed and the railway will probably be at work next spring.

The Crystal Palace Electrical Exhibition.—In deference to the wishes of the Electrical Trade Section of the London Chamber of Commerce, the opening of the Electrical Exhibition has been postponed from November, 1891, to January 1, 1892. The Chamber of Commerce were desirous of a further postponement, but the Directors were unable to agree without breaking faith with a large number of exhibitors who had applied for space, and were already preparing their exhibits. Exhibitors will be glad to learn that, in order to help towards the success of the exhibition, a large Technical Committee has been appointed by the Chamber of Commerce to act with the directors of the Crystal Palace.

The London Electric Supply Corporation.—The rumor that last week startled the electric world, and was generally voted an absurdity, now turns out correct, and Mr. Ferranti has entirely severed his connection with the London Electric Supply Corporation. The possibility of transmitting electrical energy at the high tension of 10,000 volts has always been doubted by our most practical electricians, and as a fact half that tension has been found most difficult to control. Mr. Ferranti's severance with the corporation, after his wonderful endeavors to conquer almost insurmountable difficulties, would make it appear that he had himself at last found his task too stupendous. There may, of course, be other reasons not yet made public to account for the resignation, but it is most difficult to believe other than that the consequence will be a want of confidence on the part of the public in the probability of the great engineering scheme being carried out successfully.

The Lauffen-Frankfort Plant.—On the 15th instant, Messrs. Siemens & Halske and the Oerlikon Engineering Works fulfilled their obligations in regard to the projected electrical transmission of 300 horse-power from Lauffen to Frankfort. The work was formally handed over to the exhibition committee and is now being tested by the government officials. If found to be correct, the working will be formally started next week, and the eyes of the electrical world will be directed to this gigantic experiment. The German Imperial Chancellor is greatly interested, and will most probably appoint an official commission, under the presidency of Herr von Hölmholtz, who has requested the assistance of Drs. Lowenherz, Lummer and Brodhun. On behalf of the scientific committee appointed by the exhibition authorities, Professor Dietrich, of Stuttgart, and Professor Weber, of Zurich, are already busy with their preparations for tests.

The Gaiety Theatre, Dublin.—This theatre has been lately entirely altered and very greatly improved, and is now one of the best appointed theatres in the three kingdoms. Electrical Engineering Co. did the work under the supervision of Mr. Harry South, of Garrick St., Covent Garden, who has introduced several of his patent stage appliances and special working methods. The developing plant consists of a pair of Otto gas engines of 14 horse-power each, driving two compound wound dynamo electric machines. The whole of the work reflects the greatest credit upon those engaged in it. The machinery had to be built, the switching arrangements designed and made, and the entire plant perfectly fitted in three weeks from the time the order was given. The work was carried out both by day and night and there was no labor spared. The result was that at the trial on Saturday last everything was perfectly successful.

The London-Paris Telephone.—Dr. W. H. Preece, the chief electrician to the general post office, read a most interesting paper at Cardiff last Sunday, on the London-Paris telephone, the success of which had already exceeded the most sanguine expectations. Speech had been maintained with perfect clearness and accuracy. Indeed, there was no circuit in or out of London more perfect. Speech had been possible not to Paris, but through Paris to Brussels, and, though with some difficulty, through Paris to Marseilles, a distance of over 900 miles. The demand for the wire was very considerable. The average number of "talks" per day, exclusive of Sunday, was 86; the maximum had been 108. As many calls had been made as 19 per hour, but the average was 15 during the busy hours of the day. As an instance of what could be done, Dr. Preece referred to a fact I gave you some weeks since, that 150 words per minute had been dictated in Paris and transcribed in London in shorthand. CHAS. FRENCH.

London, Aug. 26.

PERSONAL.

Mr. Charles Dutton, of the Southern Bell Telephone Company, celebrated the twenty-eighth anniversary of his marriage with his family at the Manhattan Beach Hotel, Tuesday of last week.

Mr. R. L. Trumbull, the representative in this city of the successful Chilian insurgents, is a former telephone man, having been for years identified with the West Coast Telephone Company.

Mr. Charles S. Pease, former general manager of the Brush Electric Company at Cleveland, Ohio, was a New York visitor last week. Mr. Pease, who is a gentleman of fine ability and much energy, has recently resigned from his position with the Brush company, and it is reported will shortly re-enter the electrical field as the head of a new and important company.

Mr. J. P. McQuaide, of the National Conduit Manufacturing Company, returned last week from a very successful tour in the West. At Detroit, the Michigan Telephone Company, which is having subways built, contracted for some 50,000 feet of the wrought-iron cement-lined pipe manufactured by Mr. McQuaide's company. The National Company is contemplating the erection of a factory in St. Louis, so as to be able to easily supply the Western cities.

General Eastern Passenger Agent M. C. Roach, of the New York Central and Hudson River Railroad Company, and Mr. W. R. Babcock, Southern Passenger Agent of the Central Vermont Railroad Company, have been particularly earnest and obliging in assisting Chairman Baker in getting accommodations for the electric light delegates from New York, and the REVIEW is pleased to give them this honorable mention. The well-known conservatism of the first-named road was successfully combated to the extent of getting a dining car and composite car for the special train, both of which were at first refused by the chief Vanderbilt representatives.

MONTREAL EXCURSIONISTS.

SPECIAL TRAINS FROM NEW YORK AND BOSTON.

The interest in the Montreal Convention of the National Electric Light Association, which continues through this week, secured the attendance of large numbers of delegates and others interested from New York, Boston and Chicago. In our last issue we gave a short list of the names of those who expected to go from New York, and in addition enough requests for accommodations were received by Chairman Baker to compel the putting on of another parlor car. Among these are Prof. P. H. Van der Weyde, Stephen L. Coles, Geo. L. Wiley, Col. J. W. Marsh, E. H. Johnson, E. W. Little, H. Ward Leonard, J. P. McQuaide A. R. Foote.

A number of Brooklyn gentlemen and their wives left New York last Saturday for Montreal, going *via* Alexandria Bay and the St. Lawrence River, arriving at Montreal Sunday night. In the party were F. C. Mason and wife, C. E. Stump and wife, Commissioner F. L. Dalton and wife, Fred. Pearce and wife, and Dr. A. W. Ford and wife. The party intend returning, after the Electric Light Convention, *via* Lake Champlain and Saratoga.

FROM BOSTON.

Some of the New England electrical people who attend the Montreal Convention, starting from Boston, are:

L. C. Whitney, superintendent New Britain, Conn., Electric Light Co.

F. S. Palmer, Ellsworth, Me., Electric Illuminating Co.

C. E. Bibber and wife, Consolidated Electric Light Co.

S. G. Stiness and party, Pawtucket, R. I., Electric Light Co.

J. S. Wilson, C. A. Baldwin.

H. M. Daggett and party, Attleboro, Mass., Electric Co.

M. H. Brown and wife, Eastern Electric Supply and Construction Co.

G. H. Hamblett, with Chas. A. Schieren Belting Co.

H. H. Fairbanks and party, Worcester, Mass., Electric Light and Power Co.

J. H. Craig, Holtzer-Cabot Electric Co.

F. E. Donohue and sister, Sawyer-Man Electric Co.

A. T. Clark, American Circular Loom Co.

C. B. Price and wife, Pettingell-Andrews Co.

A. B. Field, Thomson-Houston Electric Co.

Capt. Wm. Brophy, Electric Mutual Insurance Co.

O. K. Stuart and sister, Germania Electric Co.

D. F. Urquhart, Thomson-Houston Electric Co.

W. A. Hathaway, American Electrical Works, Providence, R. I.

J. H. Burghardt, Page Belting Co.

H. H. Eustis, electrician Eastern Electric Cable Co.

F. H. Carlton, Thomson-Houston Electric Co.

H. B. Cram, W. C. Fish and Geo. R. Lean, Bernstein Electric Manufacturing Co.

Col. L. W. Burnham, Electric Gas Lighting Co.

R. P. Smith, Connecticut Motor Co., Plantsville, Conn.

J. N. Pratt, Jarvis Engineering Co.

Dr. A. F. Mason, Simplex Electrical Co.

Frank Ridlon, Wright Electrical Engineering Co.

A. W. Rounds, Russell Electric Co.

Geo. W. Adams, Boston Electric Protective Association.

Fred. Pettingell and D. A. Andrews, Jr., the Pettingell-Andrews Co.

Geo. W. Davenport, Thomson-Houston International Co.

FROM CHICAGO.

The great city of the West will be well represented. Among the attendants will be W. A. Kreidler, F. E. Degenhardt, John Young, E. L. Powers, Geo. Cutter, Prof. J. P. Barrett, W. H. Temple, J. W. Dickerson, F. W. Cushing.

Telephonic News

*** The Sunset Telephone Company are putting in an exchange at Redlands, Cal.

*** New telephone poles are taking the place of the old ones in the city of Troy, N. Y.

*** The Southern Bell Telephone Company will shortly begin work on a $30,000 brick building in Atlanta, Ga.

*** What is said to be the highest telephone line in the world is one just completed between Manitou and Pike's Peak.

*** The New England Telephone Company are removing their wires from the Western Union poles leading from Portsmouth, N. H., to Kittery, and will stretch a large cable from Noble's Island bridge to the Kittery shore.

*** The new copper metallic circuit lines, in Canada, of the Bell Telephone Company, from Toronto to Peterboro', have been completed, and will be ready for use by the public on September 1. These lines will also give better connections between Toronto and points west of it, and Belleville, Napanee, Kingston, etc.

*** Mr. E. L. Smith, a former successful Western telephone manager, who has been for several years connected with financial institutions on the Pacific Coast, has returned to his first love, and is now connected with the Chicago Telephone Company. Mr. Smith is a first-class telegraph operator and telephone man, and as soon as he "renews his youth" in the matter of recent telephone development, will prove a valuable man for the Chicago company.

*** Several important changes and promotions are contemplated among the local managers of the Ontario department of the Bell Telephone Company of Canada. It is understood that Mr. Hugh Neilson, who has had charge of the Toronto business since its inception, will become Trunk Line Superintendent for the Bell Company, an office rendered necessary by the increasing importance of this branch of its service. Mr. K. J. Dunstan, of Hamilton, will take the management of Toronto, and Mr. B. J. Throop, local manager at London, will succeed him at Hamilton.

Funny Mistake of Telephone Linemen and What It Led To.

Chief of Police Bowman, of Brookline, was informed one morning of last week, says the Boston *Herald*, that two unknown men had stolen J. F. Cusick's horse and wagon from Harvard square, and the officers on the several routes were notified to look out for two men driving a light gray horse and democrat wagon. The men were seen driving through the center of the town, and disappeared rapidly up Boylston street toward Newton.

After two hours' fruitless search the chief returned to the police station, and shortly afterward Mr. Cusick appeared with the missing team, saying he had found it in the possession of two linemen of the New England Telephone and Telegraph Company.

It was not a case for the police, after all, yet the affair has its sequel. A few minutes before Cusick's horse and wagon disappeared, John Cronan, a lineman in the employ of the telephone company, ordered a carriage from White's livery stable for the purpose of putting in a telephone in a Winthrop road residence. Joseph Brown, another employé of the company, went for the wagon. Now, Mr. White has a light gray horse and democrat wagon, which are used a great deal by the telephone company.

While Mr. Brown was gone for the turnout, Cronan and a man named Nichols came out of the telephone exchange and saw Mr. Cusick's horse and wagon standing in front of the office. They supposed the wagon was intended for their use, and taking possession of it, drove off about their business, without the slightest idea that they were taking another man's property.

When Brown arrived with White's carriage, the other men were nowhere to be found, and he returned the wagon to the livery stable.

The Telephone and the Man With a Thirst.

[From the Detroit *Tribune*.]

An elegantly attired stranger walked into a Woodward avenue saloon yesterday afternoon and asked leave to use the telephone.

"Certainly," said the polite bartender.

The visitor walked to the 'phone, rang the bell, and, probably without waiting for an answer, gave a number.

"Is that Mr. B.'s residence?" asked he, giving the name of a very prominent and wealthy citizen of Detroit.

"Is Mr. B. there?"

FIG. 1.—BRYANT DOUBLE POLE SWITCH.

"Well, when he comes will you please tell him that I can't come up to dinner to-night. This is Mr. Hendrickson."

"Yes, Mr. Oliver Hendrickson."

"I am sorry, too, but a business engagement makes it impossible. I will call to-morrow. Good-by."

He stepped away from the instrument, thanked the bartender, and said:

"Give me a gin fizz, please."

He swallowed the drink, ordered an imported cigar, lighted it, and then discovered that he had no change. Looked embarrassed and then gave his name again. "Mr. Oliver Hendrickson. I'll be in to-morrow and fix it," he said.

The barkeeper didn't kick at all, the telephone conversation had fixed it. Mr. Hendrickson hasn't "come in" yet, nor has he "fixed it." The drink mixer doesn't remember the telephone number that the fellow used, but he is sure it wasn't the number of the prominent citizen's call.

The Thomson-Houston Electric Company, of Boston, have just concluded a contract with the Amoskeag Manufacturing Company, of Manchester, N. H., for the installation in their new mill of a plant of 150 arc lights of 2,000 candle-power each. This is said to be the largest single order for electrical apparatus ever placed in the State.

The Bryant Electric Switches.

The Bryant Electric Switches, manufactured by their inventor, Mr. W. C. Bryant, of Bridgeport, Conn., are very widely and popularly known in electric lighting circles. The REVIEW is pleased to present to its readers in this issue several new illustrations of these switches, all of which will be shown this week at the Montreal Electric Light Convention.

In addition to the manufacture of electric switches, Mr. Bryant reports a very great demand for his incandescent lamp sockets. The demand has been constantly increasing from the first. A number of these sockets will be included in his Montreal exhibit, and they will, no doubt, attract their full share of attention from the practical electric light men in attendance.

Heard the New Telephone.

TRAVELING FAKIRS WHO DECEIVED A CROWD OF CURIOUS COUNTRYMEN.

"My partner was a bad man," said the tramp, as he curled his legs under the Park bench and tried to persuade himself that he was not cold because the Spring sun was shining. "I confess that I was often led into sin by Jim," and his eye twinkled, as his mind recalled some piece of choice iniquity which his face and voice tried to mourn for. His tale, as told to a Philadelphia reporter, was as follows:

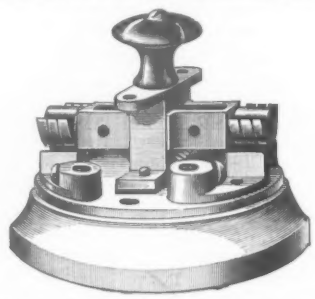


FIG. 2.—SAME, WITH COVER REMOVED.

"Jim was a glib talker and he took me into partnership selling patent medicines down South in the country towns off the line of the railroads, at fairs and on market days. I was the capper who came up and bought the stuff when the sale hung fire and Jim did all the oratory. Our luck was as good as the average, but one day we struck a town in Alabama where a well-attended fair was going on, but we could not sell enough corn-plaster or ague cure to pay for our meals. Too many of our kind had been through that town recently.

"'Jim,' I said, 'you're beat at last. And I believe you're no good!'

"'I'm not beat yet,' said Jim. Give me time to go on another tack. If I can't catch these jays one way, I can another. The telegraph operator here is an old friend of mine and I can get him drunk in half a day, if I set about it, and then I'll show you a trick worth knowing.'

"Then he got some dodgers printed at a job office and sent me to distribute them through the town, while he devoted himself to the telegraph operator. These dodgers read as follows: 'Wonderful exhibition of Edison's new telephone. After the close of business at the telegraph office this evening an exhibition will be given of this marvelous instrument. By arrangement with the head office in New York visitors can hear the famous organ in Chickering Hall playing popular music—Admission, 25c.'

"I had no idea of how the trick was to be done, but I had faith in Jim. The telegraph office closed at 6 o'clock, and by that time the operator was duly paralyzed. When the crowd began to arrive Jim had a big funnel-shaped tin attached to the telegraph instrument, and he had the "sounder" detached and an "open" wire attached to it, and so arranged under his desk that he could, with one hand, telegraph to himself. Then he made a fine speech, telling how he was traveling over the country just to introduce the new telephone. The simple funnel they saw before them was connected by wire with the telephone in Chickering Hall, New York, and he would now turn on the music.

"Then the telegraph instrument began to tick and the music floated out over the room, and the people began to express their astonishment in 'Oh's' and 'Ah's' of appreciation. We had taken in a good many quarters at the door and Jim felt encouraged. He began to talk eloquently about the wonders of the telephone, when an old chap asked:

"'Did you say this was the Chickering Hall organ we hear?'

"'Just that, my dear sir,' replied Jim, glibly. 'You see the—'

"'That's no organ,' interrupted the old man. 'It's more like a piano.'

"'I am very sorry for your ignorance,' says Jim, with calm gall, 'if you don't know a piano from an organ, and the finest one—'

"'I'm not so ignorant as you would like me to be, my fine fellow,' answered the old chap, angrily. 'I believe you're a fraud,' and before Jim could prevent him, he had reached his long walking-stick over, caught the crook about the cover of the desk, and yanked it open, revealing inside a little music-box that was playing 'The Star Spangled Banner' full tilt.

"There was a yell of rage and a rush for Jim and me and the telegraph operator. But we had been in tight places before. Quick as a flash I knocked over one lamp and Jim the other, and in the confusion and darkness we shot out a window, leaving the luckless though innocent operator to the tender mercies of the swindled Southerners."

FIG. 3.—BRYANT SINGLE POLE SWITCH.

FIG. 4.—SAME, WITH COVER REMOVED.

Transmission of Power at Frankfort.

We are advised that the plant for the transmission of power at Frankfort is now complete, and reports of the starting and tests are expected at once. The great feature of this enterprise is its entire novelty from two points—the transmission of large powers to such a long distance at enormous pressure, and the actual use of the rotary current machines. The falls of the Neckar at Lauffen, in Wurtemberg, are at a distance of 180 kilometres, nearly 110 miles, from Frankfort. Over this distance three stout telegraph wires are carried on poles fitted with insulators furnished with oil insulation. The original poles first used at Oerlikon will be seen at the exhibition. Along these wires electricity at a pressure of about 25,000 volts is to be transmitted in alternating currents, whose phases or pulsations are so arranged as to overlap or interlink with each other, forming in the machine at the receiving end a rotating magnetic polarity by which the electric power can be converted into mechanical force and so distributed. The generator of this installation, which we shall illustrate next week, consists of a 300 horse-power dynamo of the new three-phase system, constructed by the Oerlikon Company, of Zurich, in conjunction with the Allgemeine Company, of Berlin. On August 15, the date fixed by contract, the apparatus was handed over to the Board of Management of the exhibition.

The conductors required for the transmission of the current have been run by the German Imperial Postal Administration and the Royal Wurtemberg telegraph authorities. The machinery at Lauffen is already in working order, and next week the measurements and tests of strength prescribed by the Imperial and Wurtemberg Governments will take place. It is probable, therefore, that by the end of next week the transmission of electric force from Lauffen to Frankfort can be regularly begun. The power will be used as follows: Of the 300 horse-power, more or less, that is received, 100 horse-power will be used to pump water to supply an enormous waterfall in the exhibition grounds, 100 horse-power will be used for lighting purposes, and the remainder will be distributed in power transmission. The experiment is attracting the keenest interest in scientific circles and practical circles, as it is abundantly felt that the practical demonstration of the utilization of natural forces at such distances from the source opens almost undreamed of possibilities to industry in the future.—*London Electrical Engineer, Aug.* 21.

The Phonograph and Primitive Music.

[From the N. Y. *Tribune*.]

To the Editor of the "Tribune."

Sir: Chance would have it that I was in Frankfort-on-the-Main yesterday, when a *Tribune* of August 3, containing Mr. Gilman's letter on your review of Dr. Fewkes' experiments with the phonograph as an aid to the study of folk-music, reached me. I read the paper while in the grounds of the Electrical Exhibition, and embraced the opportunity offered by the various displays of phonographs to test some instruments with a view to their serviceability in such study, and especially to discover what ground Mr. Gilman might have for his belief that the phonograph "brings out delicacies of intonation that the ear cannot retain." The results were startling, so startling, indeed, that the skepticism touching the prevalence of fractional tones in the music of the Zunians, expressed in your review of the "Journal of Ethnology and Archæology," in which I shared, has been changed into complete unbelief. While listening to music repeated by an instrument of German invention and construction, in which a rotating disk is used instead of the cylinder of the American instruments, I observed that the pitch of the music several times descended suddenly nearly, if not quite, a semitone, and the nas suddenly returned to the standard. The instrument was obviously a crude device, though it gave out the sounds distinctly and with a loudness which made the usual ear tubes unnecessary. Since the rotary motion was supplied to the disk by electricity, I attributed the changes in pitch to irregularity of speed when the record was made.

The reasonableness of this theory was strikingly demonstrated by a series of experiments undertaken with the help of Mr. Graham Hope, manager in the department devoted to the Edison phonograph. There I discovered that a melody can be rendered utterly unrecognizable by irregular pedaling, and that by shifting the regulator on the instrument supplied with electrical motors, a single tone can be run through a large portion of the gamut, producing a tone similar to that which a violinist produces by sliding his fingers along a string. I then sounded a pitch-pipe, giving the A of the French diapason normal into the funnel of the instrument while the cylinder which received the record was making first 10, then 12, then 15 revolutions in five seconds, that period of time being chosen as being most practicable. The record complete, the instrument was made to repeat the note at a uniform speed throughout of 15 revolutions. The result was a sequence of three intervals, as near as I could determine hastily and with the unaided ear, a fourth, second and first of the tone given out by the pitch-pipe. The last tone was a trifle sharp, but not enough so to deceive a musical ear. Evidently it was one of Mr. Gilman's "delicate intonations," for which he could find no symbol. In repeating the tones at the lowest rate of speed it was found that the tone was lowered at each increase of speed made while taking the record, the operation being the reverse of the first. The lowest rate of speed in recording yielded the highest tone in the repetition at the highest rate; the highest rate in recording yielded the lowest tone (in one case a full fifth below) in repeating at the lowest rate. Whether or not the variations follow a rule which can be formulated with exactness, I cannot say; the circumstances did not permit the scientific accuracy and fulness of investigation and record which such a determination would demand.

I believe that the phonograph is destined become a most valuable aid in the investigation of savage music, but it must be used scientifically, not empirically. A simple device to secure absolute regularity of motion should be applied to it and the record and transmission should be made at absolutely the same rate of speed and with unquestioned regularity of motion. I f ar, too, that the instrument has other vagaries which ought to admonish an ethnological or musical student to study its voice caut ously. I confess that I part with regret from the Zuni melodies which Dr. Fewkes imprisoned on his phonograph cylinder and Mr. Gilman transcribed for us (those quarter-tones opened up such a delightful field for speculation); but since I toyed with a phonograph and pitch-pipe at the Frankfort Exhibition yesterday, they are banished from my collection. It is not proved that the Zunians are first cousins, musically, with the Hindoos, Arabs and ancient Greeks.

H. E. Krehbiel.

Ruedesheim-on-the-Rhine, Aug. 15.

A New Needle Annunciator.

The Electric Gas Lighting Company, of Boston, having received numerous calls from their Southern and Western customers for a lower-priced annunciator than their "Tirrell" gravity drop instrument, one that not only should cost less, but prove of equal quality and efficiency, have begun the manufacture of a needle drop annunciator of simple and practical construction.

The new instrument has been christened the "Hub" needle annunciator, and it may be relied on as in every way a first-class device of its kind. A single magnet operates a

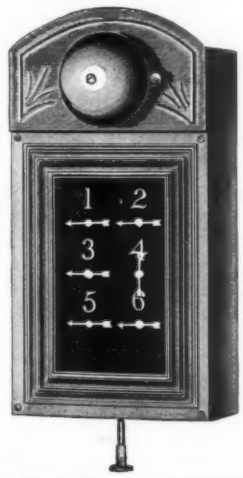


Fig. 1.—New Needle Annunciator—The Electric Gas Lighting Company, Boston.

gravity needle drop, which is replaced by a mechanical set-back. The drops are mounted on a metal base, which cannot warp or shrink to throw the mechanism out of adjustment; the whole being arranged on a decidedly novel and simple plan.

The "Hub" annunciator is smaller, has fewer parts than customary, and occupies the least possible space; the parts are easily accessible for repairs or adjustment; it requires a minimum of battery power, and is warranted to hold its adjustment through all seasons and temperatures and to require the least possible attention..

Comparative Test of a Chloride of Silver Dry Cell and an Acid Cell.

BY G. A. LIEBIG, JR., PH.D., IN THE CINCINNATI "MEDICAL JOURNAL."

Although every one who has ever used an acid battery is well aware of the fact that it is not a constant source of electricity, and, moreover, that even when on open circuit, its electromotive force is subject to a continual and sometimes rapid diminution; still I have thought that it might be interesting to make a comparative test between an ordinary acid battery and a chloride of silver cell, and exhibit the results in such a way that their great differences in this respect could be seen at a glance.

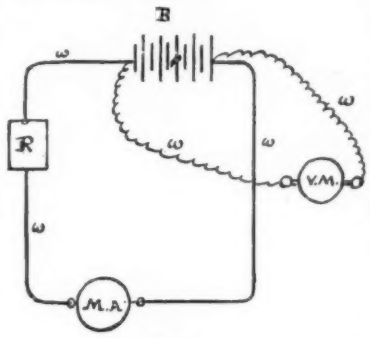


Fig. 1.

With this object in view, an acid battery of five cells was joined in circuit with a resistance box and an ammeter, a voltmeter being also in metallic connection with the terminals of the battery. The battery was of the ordinary zinc carbon chromic acid form, the size of the zinc plate being about 3x1⅜ inches, and the chromic acid solution being made up of water, five pints; sulphuric acid, seven fluid ounces; chromate of potash, eight ounces.

The voltmeter was not continually in circuit. Only when a reading of the electromotive force was taken was this the case, the circuit being made by means of a push button with which the voltmeter was provided. Both the voltmeter and milammeter were of the Weston type, and had, only a few days previously, been received from the manufacturer's laboratory.

Fig. 1 shows the manner in which the various pieces of apparatus were connected. *B* is the battery of five cells; *R* is the resistance box or rheostat; *M A* the milammeter (always in circuit); *V M* the voltmeter, and *w w*, etc., are the wires or conductors completing the circuit. The voltmeter and ammeter were placed at a distance apart sufficient to insure complete absence of any disturbing effect of one on the other—a precaution, which, however, for ordinary purposes, is unnecessary, as the Weston instruments are practically unaffected by surrounding magnetic conditions.

Frequent observations of the current, as well as the electromotive force, were made during the day, the values tabulated, and from these curves were plotted, which are shown in Fig. 2.

Curve *A B C* was constructed from the values of current furnished by the chloride of silver cell, curve *D E F* having been similarly constructed for the acid cell. As the size of the zinc plate in the latter was at least five or six times as great as that of the chloride of silver cell, the resistance in circuit was adjusted so as to make the current from the acid battery about two and a half times as great as that from the chloride of silver battery. The resistance, however, in both cases was not changed during the test, but remained always the same as at the outset.

A glance at the curve shows how very differently the batteries behaved. Starting at nearly 26 milamperes, the current from the acid battery began at once to diminish, and after 10 hours had fallen below that of the

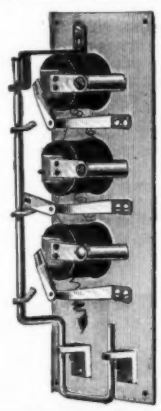


Fig. 2.—View Showing Interior Needle Annunciator.

silver chloride cells. After 20 hours of service it had diminished to between five and six milamperes, which value was subject to but little subsequent change.

During this time the electromotive force fell from 1.80 volts per cell to 0.32 volts. After 20 hours' service the electromotive force was 0.37 volt, so that practically the battery was then useless.

After being in circuit about 80 hours the battery was disconnected and allowed to recuperate. The recovery was insignificant, amounting to only about 0.12 volt per cell.

The curve *A B C* shows that the current from the silver chloride cell, starting at about 10.2 milamperes, gradually increased until it reached the value 12.0 milamperes, after which it remained practically constant until the cells had been in operation for about 75 hours. This rise in the current, as well as in the electromotive force (which for these cells is almost exactly one volt), is due to the gradually diminished internal resistance of the cells, consequent upon the conversion of chloride of silver—a comparatively poor conductor—into metallic silver, a very perfect conductor. The change is, however, small, and

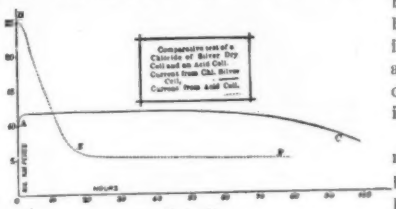


Fig. 2.

could be avoided by short-circuiting the cells for a few minutes—a proceeding which is not advisable. The theoretical capacity of these cells, calculated from the weight of the chloride of silver contained in them, is about 1,000 milampere hours, and the curve shows how nearly the actual life corresponds with that given by theory.

TELEGRAPHIC

.... A company has been organized with $6,000 capital to build a telegraph line from Forest Grove to Tillumook, Ore.

.... The Postal Telegraph Company are building a line from Boston, Mass., to Springfield, which is almost completed.

.... A long felt want is about to be filled by the establishment of a Western Union Telegraph office at Greenwich, Conn.

.... A company is now being formed in Dubuque, Ia., with a capital stock of $20,000, to handle the Woolley magnetic engine. This company will control the letters patent and the manufacture for the United States.

The Saratoga Electric Road.

The Saratoga Electric Railway Company, Saratoga, N. Y., has just made the following report to the railroad commissioners at Albany for the year ending, June 30:

Gross earnings	$1,601 50
Operating expenses	1,965 56
Deficit	366 86
Fixed charges	4,250
Deficit for the year	4,613 86

The general balance sheet shows:

ASSETS.

Cost of road	$98,629 52
Cash on hand	1,069 90
Profit and loss, deficiency	4,613 86
Total	$104,313 28

LIABILITIES.

Capital stock	$50,000
Funded debt	50,000
Interest on funded debt	4,250
Open accounts	63 28
Total	$104,313 28

The length of the road, single track, is two and one quarter miles. The company owns five open cars and two motor cars and during the year carried 32,000 passengers.

Electrical Stocks in Boston.

Detroit Electric is again attracting attention, and the long promised advance in it seems to be at hand. The insiders have found the market of late unpropitious for a movement, but they are now getting ready, so "the street" says, to lift it to a higher point than it has heretofore touched. It sold as high as 10⅝ to-day, and the demand was most excellent. The company's business at the present time is growing in a very satisfactory manner. It has recently secured several valuable contracts and has a most excellent prospect for business ahead.

Westinghouse has been another of the features of the local market. It has sold up from 12⅞ to 13¾, and at one time ¼ of one per cent. was bid for the right to call the stock at 15 for 30 days or at 18 for 60 days. The adjourned special meeting of the stockholders to finish up the reorganization arrangements is "booked" for to-day at Pittsburgh, but there is, as a matter of fact, very little left to be accomplished.

That the present movement in Thomson-Houston stock is due, in part, to shrewd bull manipulation, there can be no question, but, on the other hand, it is equally true that there is a substantial basis for it. The company has recently added 100 men or more to its working force, and now has, all told, over 2,900 men in its shops at Lynn. Its orders of late in all its departments have been unusually large, and it is doing a better business at the present time than ever before in its history. The stock has continued active and the buying of the same has been of the most excellent character, and has put it up to 46.

At the close of the first six months' business of the Thomson-Houston Electric Company, August 1, the liabilities of the company were more than $300,000 less than upon February 1, the date of the last annual statement. During this period the company has paid to its stockholders $620,000 in dividends.

One-quarter of one per cent. was bid at the local board this morning for the right to call 1,000 shares of Thomson-Houston stock at 50 at any time during the next 60 days.—*Boston Traveler.*

* * The new electric railway at Reading, Pa., was opened Tuesday, September 1.

* * Austin, Minn., is reported to be coming to the front with an electric street railway.

* * The draw of the Federal street bridge, in Boston, is now operated by an electric motor.

* * At Danvers, Mass., the citizens expressed themselves in favor of electric cars in that city by a vote of 426 to 127.

* * Work on the extension of the electric street car line of Clinton, Ia., has been begun and is being rapidly pushed forward.

* * The West End Street Railway Company, of Boston, are contemplating heating their cars by electricity during the coming Winter.

* * Cambridge, Mass., capitalists have formed a syndicate to build and operate an electric railway between Marlboro and Westboro.

* * The question of making use of the highways for electric roads is being discussed with much vigor by the citizens of San José, Cal.

* * Work has been commenced on the Ironville extension of the Consolidated Electric Road, of Toledo. An additional mile of road will be built.

* * The Dubuque Ia., Street Railway Company has received a new Corliss engine, which is to be used to supply electricity for the storage battery cars.

* * The laying of the track for the electric street railway in Martinsburg, Md., is making rapid progress. A mile of road will be in operation in a few days.

* * The West End Street Railway Company, of Boston, have just closed a contract with the Newburyport Car Company for the building of 20 more large electric cars.

* * After a very careful examination, the supervisors of Santa Clara County, Cal., have granted a franchise to Felix Chappellit for an electric road through the county.

* * An interesting and entirely successful experiment was recently made in Germany, which demonstrated that silk worm looms can be run much more satisfactorily by electricity than by the caloric engines or gas motors now in use.

* * It is reported that San Francisco capitalists have bought the Stockton street railroad and intend extending the track in several directions. When completed they will have about 10 miles of double track, and will operate the entire system by electricity.

* * The Hamilton, Lindewald and Electric Transit Company, of Hamilton, Ohio, have just closed a contract for iron ties and ten new cars. The contract for constructing the new line to the fair grounds has also been awarded and work will be commenced just as soon as the material arrives.

* * Cincinnati, Louisville and Buffalo parties—the same syndicate operating the Buffalo street car line, the Zoo and the inclined plane at Cincinnati—made application recently to the Board of Public Works of Columbus, O., for a franchise in that city. They propose to build and operate an extensive system of electric roads. The officers are: President, H. M. Littell, Cincinnati, president and manager of the Cincinnati Incline Plane Railway Company; secretary, Jas. M. Doherty, Cincinnati; treasurer, Edward Buttman, Cincinnati. Northern directors, St. John Boyle and J. W. Gaulbut, of Louisville.

* * A $500,000 electric smelting plant will soon be in operation in Pueblo, Colo. Negotiations are now pending between American and English capitalists for the formation of a company capitalized at $2,000,000, of which $500,000 will be subscribed at once; $300,000 of this will be put into the plant at once, and $200,000 reserved for an operating fund. The works will be intended especially for the reduction by electricity of dry and refractory ores, though all kinds can be handled. The capacity will be about 200 tons a day, and at least 200 men will be employed. Ground will be broken inside of 60 days.

* * The reorganization of the Brockton, Mass., Street Railway Company has just been completed. The controlling interest in the road is now held by the Industrial Improvement Company, of Boston. The new board of directors consists of Geo. H. Campbell, of Boston, president; A. A. Glazier, of Boston, treasurer; F. B. Howard, of Brockton, assistant treasurer; John P. Morse and C. F. Porter, also of Brockton. In the Spring the road will be extended to Holbrook, North Easton, Stoughton, Rockland and Abington, which will then give an electric railway with Brockton as the center and connections in eight different towns.

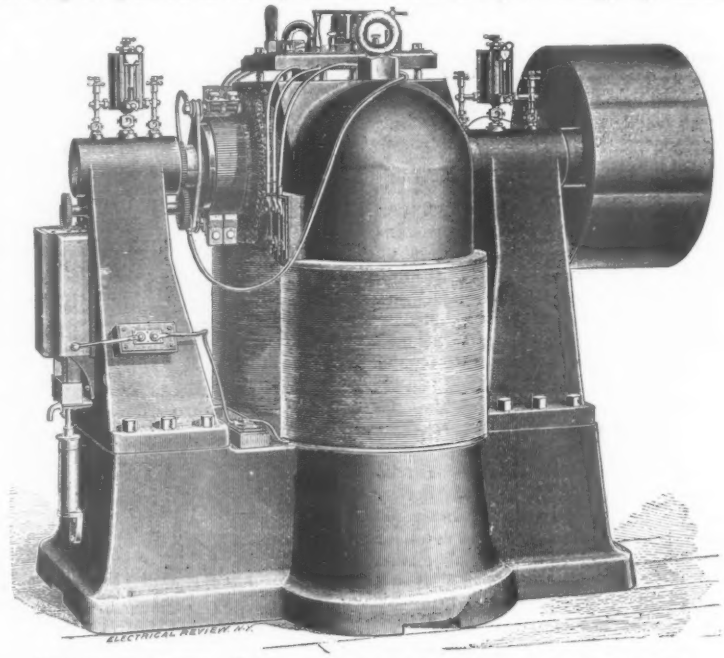
A Big Power Plant in Philadelphia.

A most imposing plant, illustrating both subdivided power and the mechanical operation of a fire-room, is that in the sugar refinery of Claus Spreckels, of Philadelphia. The contract, which was carried out by Westinghouse, Church, Kerr & Company, involved in the boiler-room, the stoking and handling appliances to serve a battery of 7,500 horse-power Babcock & Wilcox boilers. These boilers are arranged on the floors of a double-deck boiler house, the third floor being utilized as an immense coal bunker with a capacity of 3 000 tons, the daily consumption being about 250 tons. The motive power for the conveyors is a 45 horse-power Westinghouse engine perched among the roof timbers of the building, 98 feet above the ground. This engine makes 300 revolutions, and though exposed to an unusual amount of dust, runs without attention, except to stop and start. On one end of the shaft is keyed a grooved pulley, from which a rope drops sheer down into the cellar 10 feet below the ground level, to drive the coal crushers. It is most impressive to stand on one of the intermediate floors of the boiler-room and see this rope gilding through the four inch pipe which is belted to the floor and stands about six feet above it as a protection, with no sign of engine or machinery near to indicate whence the power comes or where it goes. This is undoubtedly the largest plant for mechanical stoking in the world, and has given remarkable results in the way of fuel duty, cost of labor and smokelessness. An artificial draft is used, and it is doubtful if the general results could be duplicated in any other fire room now in service.

Electric Power in a Big Brooklyn Factory.

An Interesting Power Plant.

The Lidgerwood Manufacturing Company in South Brooklyn, N. Y., are using a Thomson-Houston power plant with great success. We illustrate the factory showing the generator at the top on the right. There are supplied from the generator one 10 horse-power motor on the crane for hoisting and for moving the crane, and one 3 horse-power motor for moving the carriage on the crane; also, about 40 lights are running on the same circuit. The plant has been in use for about eight months, without complaint of any kind, doing all the work required. In one instance there was hoisted a casting weighing nine tons from a bed of clay without any difficulty. To see this immense crane at work, receiving its power from a slender wire, is a very impressive sight—one calculated to thoroughly imbue the beholder with the great power contained in the electric current.



Dynamo for Mines.—Electrical Engineering Company, San Francisco.

The Black Diamond Mines Dynamo.

The accompanying engraving represents the dynamo made by the Electrical Engineering Company, of San Francisco, for the Black Diamond coal mines near Seattle, Wash.

This dynamo has a capacity of absorbing 120 mechanical horse-power and giving off to an electric circuit more than 90 per cent. of that in electrical energy, says the San Francisco *Mining Express*. It is of the constant current type, with variable electromotive force, and the armature is wound under the Keith patent of November 30, 1886. It is perfectly self-governing in preserving a constant or uniform current, and in varying the electromotive force to suit the requirements for power at the motor, or motors, on the circuit.

At the Black Diamond mine it supplies electric energy to an 80 horse-power electric hoist, located at the head of a slope, 3,100 feet from the mouth of the mine. By this method, a train of cars carrying 12,000 pounds of coal can be hoisted up the slope, which is 450 feet long, with a grade of one to three, in one minute. The simple movements of one lever controls the hoist in all its movements, and much more readily than is the case with a steam or compressed air hoist.

But three horse-power, it is claimed, is lost in conveying the necessary power to the hoist.

The Porter Electric Motor.

The Porter electric motor, illustrated in this issue, is built in three sizes, and its manufacturers—the Electric Gas Lighting Company, Boston—state that an entirely novel principle underlies the construction, both electrically and mechanically, insuring simplicity, low cost, reduced size, diminished weight, higher speed and wonderful economy in power required to operate them. The No. 1 motor (see page 35), although a very small one in size, is highly efficient. With one cell of acid battery it will operate a small dental lathe, a fan, a revolving window stand, an egg-beater, a music-box, etc. It is no toy. Its electrical efficiency is about $\frac{1}{12}$ horse-power, or from 35 to 40 watts on a continuous run. It is an excellent motor to meet the wishes of young students engaged in the study of experimental physics.

The Brooklyn and Coney Island Railroad Company has closed a contract with the Short Electric Railway Company for electric equipment to be put upon its line. This is one of the most prominent electric railways in the country, and its traffic has been so heavy as to seriously tax its present equipment. If the "Gearless" can do the work upon this line, it can do work anywhere, as very heavy cars are used and the loads are frequently excessive.

Pulley Clutch.

A new clutch, well adapted for dynamos, is illustrated in the accompanying engravings, Fig. 1 showing a side elevation, partly in section; Fig. 2, a longitudinal central section; Figs. 3 and 4, details, and the remaining figure, a perspective view. The clutch is manufactured by the Allentown Foundry and Machine Company, of Allentown, Pa., under the patent of W. J. Woodcock, Auburn, N. Y. The pulley is provided with a long hub *I* mounted freely upon a brass bushing *J*. The coupling *H* is provided with a long bearing surface and is spliced to the shaft. Upon this coupling is a sleeve *G* adapted to be shifted back or forward by means of a fork and collar in its groove. A lever *F* is pivotally mounted on this sleeve; the lever is forked at its outer end,

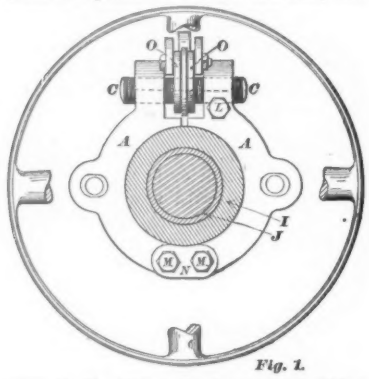


Fig. 1.

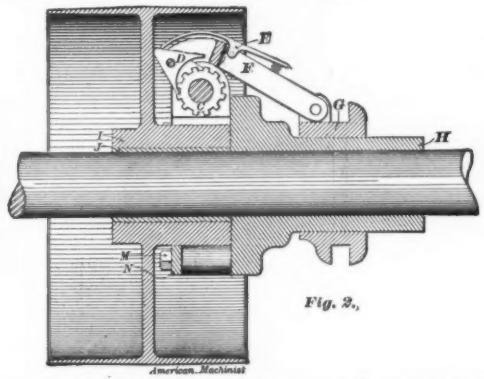


Fig. 2.

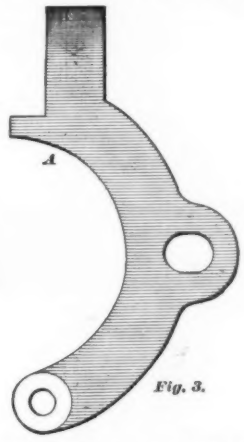


Fig. 3.

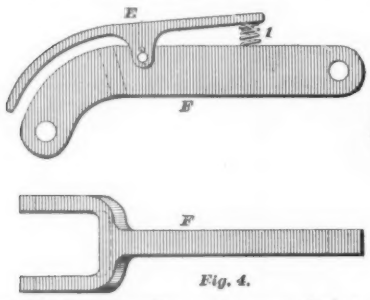


Fig. 4.

the fork surrounding a pin upon which is mounted a pawl *D*. The pin is secured to links journaled on a bolt *C*, provided at its extremities with right and left hand screw threads co-operating with two clamping jaws *A A* pivoted at the bottom and strengthened by a plate *M*. The jaws are journaled on an extension of or on bolts passing into the coupling *H*. By shifting the sleeve *G* to the left the forked end of the lever *F* forces the links upon which the pawl *D* is mounted to rotate, thus rotating the ratchet wheel securely fixed on bolt *C* and tightening the clamping jaws *A A* about the hub of the pulley. A reverse movement of the sleeve *G* or a movement to the right in Fig. 2 shifts the upper finger of pawl *D* into engagement with the ratchet wheel, and thus operates the screw in a reverse direction, opening clamping jaws *A* and disconnecting the coupling. A finger, *E*, fulcrumed on the back of the lever *F*, and provided with a spring, as shown, permits a sliding connection with the pawl *D*, and in being shifted, when the sleeve *G* is operated, to one side or the other of the center of the pin on which pawl *D* is mounted, causes this pawl to tilt so as to bring its upper or lower finger into operative relation to the ratchet wheel. The marked advantage claimed for this clutch is that the tightening may be gradual, thereby bringing the machinery slowly into operation and avoiding exceptional strains on starting.

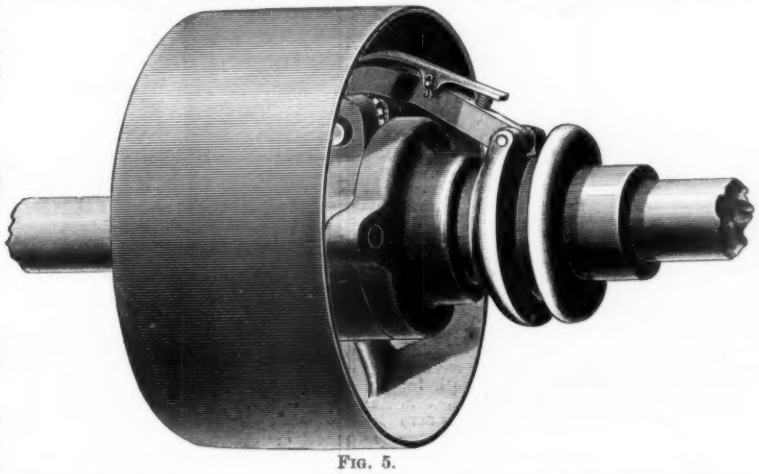
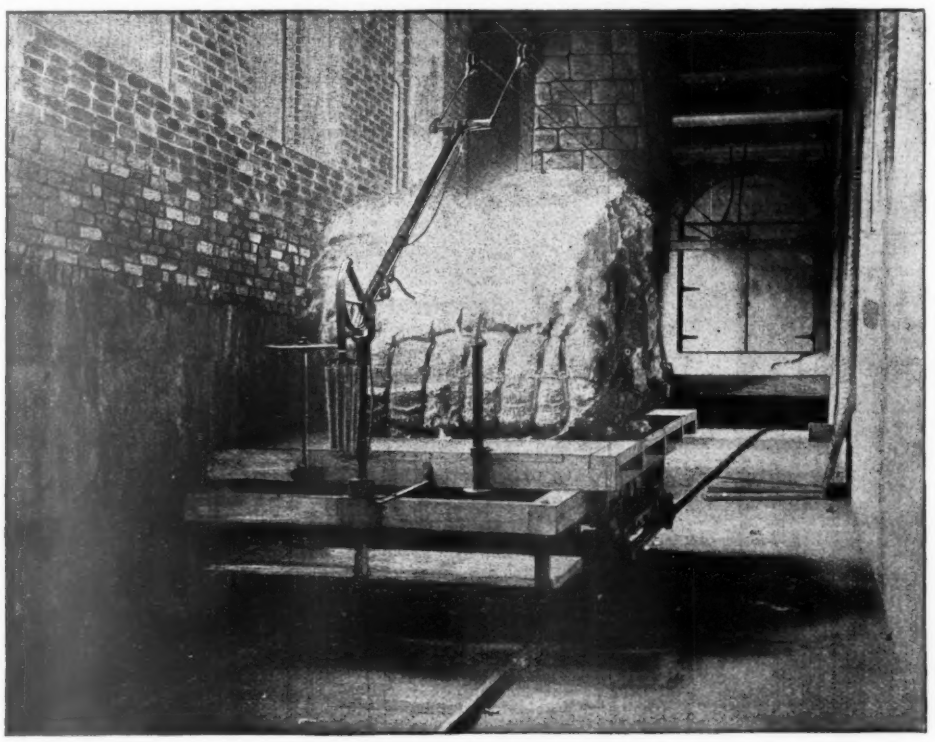


FIG. 5.


ELECTRIC TRAMWAY—JACKSON MANUFACTURING COMPANY, NASHUA, N. H.

Electric Tramways.

The saving in time and money made by the use of electricity as a motive power for the handling of heavy materials in manufactories is shown very completely in the plant recently installed by the Thomson-Houston Motor Company, of Boston, Mass., at the mills of the Jackson Manufacturing Company, of Nashua, N. H. The Jackson Company has for a number of years transported its cotton from the cotton house to the picker room by means of platform trucks running on rails, which were loaded with cotton and pushed along by men. When the motive power was changed to electricity the same rails were used and the road was equipped with a three horse-power motor car. Instead of the six men formerly employed two men do the entire work, thus accomplishing a great saving, both in time and money. A wooden tunnel, the full length of the cotton house (300 feet), about eight feet wide by ten feet high, contains the track. About every 50 feet openings are made in the tunnel, from which the cotton is taken and loaded on the car.

The illustration shows the motor car, with a load of cotton, near the end of the route. The iron doors seen at the end of the tunnel open into the picker room. The motor car is also employed as a locomotive for hauling coal from the coal sheds to the boiler room, which is situated at the right of the tunnel next the picker house. As will be seen by reference to the cut, the double trolley system of wiring is used, thereby avoiding the use of the rails for the return circuit. The total length of the track is about 300 feet, with a gauge of four feet. The road has a grade of three degrees, notwithstanding which, loads of 4,000 pounds weight are easily handled by the motor car. The current is furnished by a 200 volt Thomson-Houston generator of the type known as D-7½, which also furnishes current for lighting the tunnel.

ELECTRIC LIGHT NEWS

—— Franklin, Pa., is greatly rejoiced over its fine electric lighting.

—— The Electric Light and Power Company of Grand Haven, Mich., has been granted a franchise.

—— The ordinance granting the Citizens' Electric Company, of Bessemer, Colo., a franchise, has passed.

—— The citizens of Deposit, N. Y., have subscribed about $12,000 for an electric light plant in their town.

—— Macon, Ga., is asking that the next meeting of the National Electric Light Association be held in that city.

—— Scranton, Pa., is increasing its city lighting, a number of new arcs having been ordered by the city council.

—— The Citizens' Illuminating Company, of Brooklyn, N. Y., is arranging for putting up an extensive addition to its station.

—— At South Norwalk, Conn., the city council has been requested to appropriate $22,500 for an electric light plant for the city.

—— Arrangements are being made to at once put into active operation the proposed extension of the electric light system at Alton, Ill.

—— The Hyde Park Light Company, of Massachusetts, has now on hand orders for wiring more than 30 houses for electric light purposes.

—— A deacon who said recently that the light which Moses saw in the burning bush came from an electric light plant is to be tried for heresy.

—— Work on the new electric lighting plant at Abington, Mass., is progressing rapidly, and it is expected that it will be in operation by October 1.

—— A number of garden parties have been tendered by the ladies of Montreal to the gentlemen and their wives who attend the Electric Light Convention.

—— The Thomson-Houston Electric Company have a force of men at Montville, Conn., making preparations to establish a plant in the Uncasville mill.

—— The citizens of Braintree, Mass., have expressed their sentiments in relation to electric lighting for their town by a vote of 119 to 3. They evidently know what they want.

—— The Consolidated Milling Company, of Minneapolis, Minn., is putting in an electric plant at the Pettit mill, designed to furnish lighting facilities for all five of its mills.

—— The electric light company at Duluth, Minn., has offered to sell its plant to the city for $87,500, $40,000 of which is to be paid in cash or village bonds, at six per cent., on acceptance of the proposition.

—— The stockholders of the electric light plant at Kansas City, Mo., now propose to enlarge their plant by the erection of a new building, adding new engines, etc., and make it first-class in every respect.

—— The application of the Consumers' Gas Company, of New Bedford, Mass., for permission to lay pipes in the street, has been dismissed by the Board of Public Works. They probably want electric lights.

Queen's New Laboratory Photometer.

With the exception of a small portable photometer brought out by Messrs. Queen & Company, of Philadelphia, something over a year ago, they claim that there has not yet been put upon the market a thoroughly good photometer, especially for electric light work. Appreciating the demand for an instrument especially adapted to electrical measurements, and provided with accessories to this end, Messrs. Queen & Company last Spring took up the problem and have brought out the photometer here described. The instrument and accessories were designed by Mr. Elmer C. Willyoung, of Queen & Company; the first one built was recently sold to the Standard Lamp Company, of Appleton, Wis., where it is giving great satisfaction.

The photometer is of the usual Bunsen type. Two tables, each four feet long by 20 inches wide, support the graduated bar and accessory pieces. These tables are of white wood with ebonized top and can be firmly screwed to the floor; the table legs unscrew so that the whole apparatus can be packed in a comparatively small compass for transportation or storage. The tables stand at such a height that observations may be taken by a man of medium height without bending. The bar is of metal, supported by a large bar of wood; the graduated bar is made in several different lengths, and either graduated directly in candle-power or else in the metric system, to half-centimetres. The wooden bar is made with a cross rail along the bottom, along which rides the carriage containing the Bunsen disk or "grease spot;" this carriage is arranged so as to rotate through 180 degrees about a vertical axis, thus allowing measurements to be made with each eye alternately toward each light and, hence, taking the mean of observations, eliminating largely the errors due to differences of vision between the two eyes.

As a standard may be used a candle balance, a Methven screen, or an incandescent lamp, as may be preferred. The table shown in Fig. 1 is provided with cross rails parallel with the width of the table. The candle balance is mounted upon a base fitted to these rails and when drawn forward to the limit of the rails is in correct position for use as a standard. Pushing the balance back out of the way brass bed-plates are disclosed, upon which the Methven screen or standard incandescent lamp (held by a special socket) may be placed and firmly fixed by means of two milled head screws. The right hand table is also provided with bed-plates in such a way that the universal

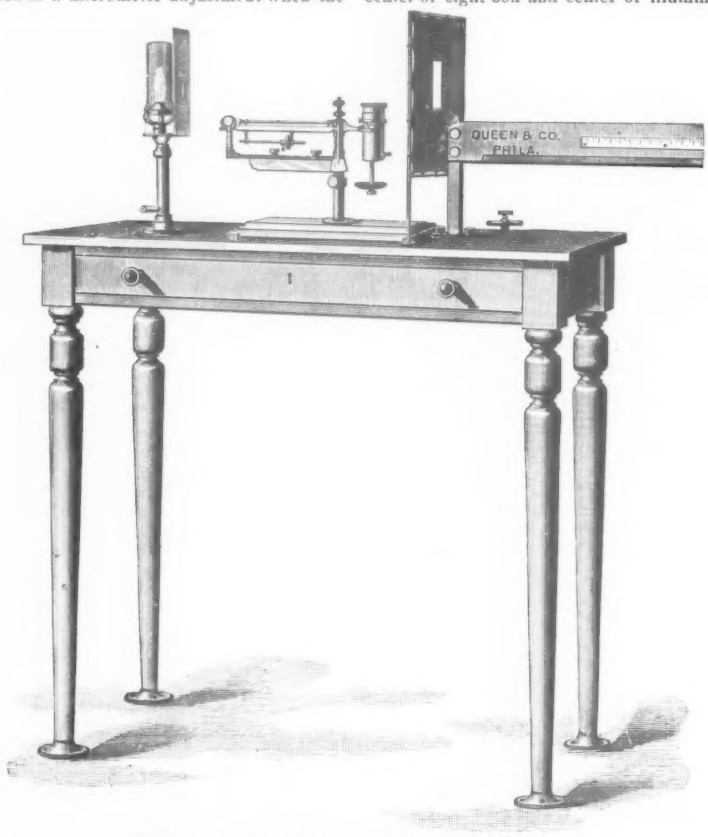


Fig. 1.—Queen & Company's New Photometer.

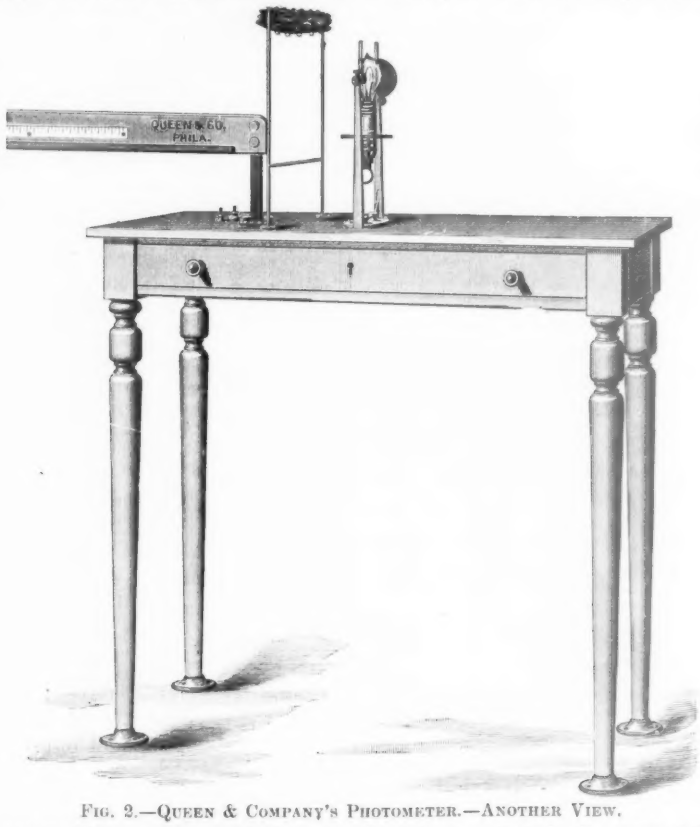


Fig. 2.—Queen & Company's Photometer.—Another View.

socket, the Methven, or the standard incandescent, may be placed in position and their light measured by comparison with any of the other standards; hence the checking of the standards among themselves or the standardizing of the standard incandescent lamp can be very easily and quickly done.

The candle balance, seen more in detail in Fig. 3, has been arranged for weighing candles while burning. The bar of the balance is graduated in half grain divisions, and differences of weight can be read off, by means of the rider, up to 50 grains. Equilibrium is secured by means of a counterpoise weight sliding along a rod beneath the balance beam; the rod itself is threaded at one end so as to be used as a micrometer adjustment when the counterpoise weight is fastened by means of the check screw. Either one or two candles may be used, as desired. The balance also has an adjustment in its own length for bringing the line passing through the centers of the candle flames exactly at the zero of the scale.

For holding the incandescent lamp to be measured, the universal socket, shown in Fig. 4, has been devised. By means of this socket any lamp of any make may be presented at any angle whatsoever to the sight box. This socket consists, essentially, of a lamp socket, with its central axis perpendicular to a graduated circle (by an error of the engraver this cut is not shown graduated). This socket can be rotated about this vertical axis and clamped in any position; the amount of rotation is measured by means of an index attached to the socket. A small set screw allows the index to be set at zero when the plane of the carbon filament is at right angles to the table length. The socket as a whole can also be rotated about a horizontal axis, cutting the line passing through center of sight box and center of illumination of the standard; the amount of rotation is read here also by means of an index and graduated circle. In order to bring the axis of greatest illumination of the lamp into the axis passing through the center of sight box, the frame supporting the socket proper may be raised or lowered to whatever point desirable and there fastened. With the universal socket, as with the candle balance, there is a small adjustment in the length of the table, thus allowing the axis of greatest illumination to be placed exactly at the end of the scale. Both circles are graduated to every five degrees. The standard incandescent socket, not shown in the cuts, is designed to hold an incandescent lamp to be used as a standard. As before stated, this lamp socket may be placed upon the right hand table and its candle power measured by comparison with either the candle balance or the Methven screen; it may then be placed upon the left hand table and used as a standard, thus making both the standard and lights measured of the same color and, hence, greatly facilitating observations. Curtains are provided for excluding extraneous light. All metal parts are finished dead black.

It is intended, as time permits, to adapt to this photometer several different accessories for use in taking measurements according to different methods, as, for example, Professor Nichols' spectro-photometric method, the method of Lommer & Brodhun, recently described, etc. It is expected also to adapt the photometer to arc light measurements by adding certain accessory pieces.

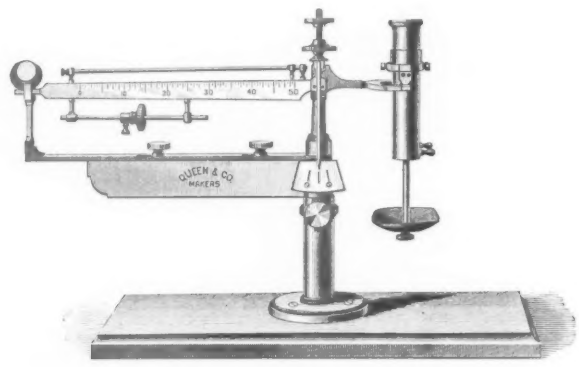


Fig. 3.—Candle Balance.

Alternating Current Motors.

FROM A PAPER READ BEFORE THE FRENCH PHYSICAL SOCIETY, BY M. E. HOSPITALIER.

The distributions of electrical energy by alternating currents are comparable, in number and power, in America at least, to similar distributions by continuous currents, but they would soon outnumber the latter if we knew how to turn to advantage the electrical energy distributed in an alternating form for electro-chemical operations into which electrolysis enters; if we knew how to store up the electrical energy supplied by these currents; and, lastly, if we knew how to convert this electrical energy readily into mechanical work. For all these applications the continuous current has, up to the present, been preferred to alternating currents. But the inconveniences that we have just mentioned are in a great measure compensated for by a number of advantages, among which may be mentioned the simplicity of construction and economy of alternating current machines or alternators, the easy production, either directly or by transformation, of very high electromotive forces, whereas, it is difficult to exceed 3,000 volts with continuous currents; simplicity and facility of insulation, and, lastly, facility and simplicity of transformation, by

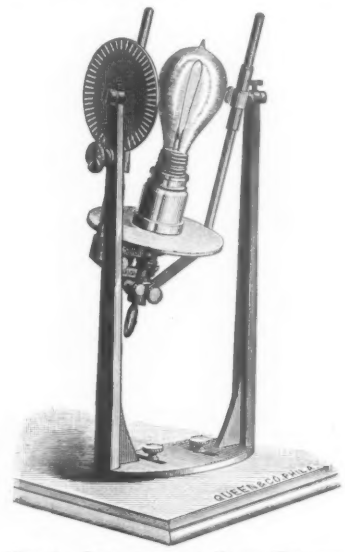


Fig. 4.—Incandescent Lamp Holder.

means of inert apparatus, containing no movable parts, and giving a very high efficiency, reaching 95 per cent. If the utilization of alternating currents for electro-chemical operations and for the storage of the electrical energy which they convey is a problem that has scarcely as yet received serious consideration, and the partial solutions of which still remain within the domain of experiment, the same cannot be said of alternating current motors; the principles applied and the various types based on one principle are already so numerous that they admit of a classification which is summed up in the following table:

A.—Constant Field or Synchronous Motors.

Separate excitation. } Magnets. Electro-magnets. Magneto-alternators. Dynamo-alternators.
Self-excitation. Redressed current. Zipernowsky.

B.—Alternating Field Motors.

Series dynamo. Continuous current motors with foliated inductors.
Shunt dynamo. Continuous current motors with foliated inductors.
Electro-dynamic motors. The E. Thomson motor.
Field partially redressed. Mordey.
Closed armature. E. Thomson.

C.—Revolving Field Motors.

Ordinary or single circuit alternators		Ferraris. Tesla. Schallenberger. Huntin and Leblanc.
Alternators with multiple phases or with poly-phased currents.	3 wires and 2 currents.	Ferraris. Tesla. Borel.
	3 wires and 3 currents.	Dolivo-Dobrowolsky and Brown. Haselwander. Bradley. Wenström.

An alternating motor does not differ essentially in its general principles from a continuous current motor; we always find the same two essential parts, a system producing a magnetic field or *inductor*, and an induced system or armature, turning in relation to one another; but, whereas the magnetic field of continuous current motors is always constant, that of alternating current motors is, as the case may be, constant, alternating or revolving.

A. Motors with a constant field.—This kind of motor, which was the first tried, is based on the principle of the reversibility of the alternators. The alternating current is sent into a series of induced bobbins moving in a constant magnetic field produced by a magnet or electro-magnet. The simplest consists of a double T Siemens bobbin turning between the prongs of a magnet or of an electro-magnet excited by a foreign source; if the armature is started at an angular speed, corresponding to the frequency of the alternating current furnished by the alternator (50 turns per second, for instance, if the frequency of the alternating current is 50), the movement of the induced bobbin will continue synchronically, and will follow all the variations in speed of the alternator, unless a resistant couple exceeding a certain value should be suddenly applied upon the axle. The necessity of bringing about the synchronism at the beginning, and of maintaining a vigorously constant angular speed has prevented the motors from being used extensively for industrial purposes. M. Zipernowsky has overcome two of the most serious drawbacks to these motors by making them self-exciting, the excitation being supplied by a shunt in which is introduced a current reverser; the motor is started automatically, provided that the charge is suppressed, and the starting is effected when disconnected; it rapidly attains the required angular speed, which it afterwards maintains invariably, notwithstanding the sudden variations in the resisting torque.

The rendering of these motors is most satisfactory, amounting to 80 per cent. for a motor of four kilowatts.

B. Motors with an alternating field.—Every continuous current dynamo fed by alternating currents can start and turn, producing an appreciable mechanical power, as it may be compared to an electro-dynamometer, the torsion couple of which remains always of the same sign, notwithstanding the reversals in the nature of the current. But a motor of this construction has many serious defects; the frequent reversing of the current develops in the cores of the inductors Foucault currents, which considerably reduce the efficiency of the motor if we do not take the precaution to laminate these inductors; the high co-efficient of self-induction in the circuits of the motor reduces the effective intensity, and consequently the specific power or output of a motor of given dimensions.

For these reasons, motors of this type are little used, except in cases where low power only is required to be produced; we may mention, for instance, the motors which work small domestic ventilators expending one to two amperes at an effective difference of potential of 50 volts, these apparatus being now used extensively in America. The excitation of these motors is sometimes arranged in a shunt and sometimes in series. By suppressing the iron in the inductors and armatures, we can also realise an electro-dynamic motor of low specific power, but its motive couple is, at each moment, in proportion to the product of the intensities of the currents passing through the inductors and the armature, respectively.

In order to avoid losses through Foucault currents and through hysteresis arising from the rapid reversing of the magnetization in the inductors of motors with an alternating field, M. Mordey has proposed to make the alternating current pass through a reverser mounted on the axle of the motor. At the moment of starting, the action of this reverser is *nil*, but as the angular speed increases, the current passing through the motor is acted upon more and more, *i. e.*, the frequency of the reversals diminishes, and thus the losses caused by these reversals are reduced and the efficiency is improved.

The motors with closed armatures may also be included in the class of motors with an alternating field. Prof. Elihu Thomson's experiments on electro-dynamic repulsions have shown that a closed circuit placed in an alternating field has a tendency to become displaced so as to bring its co-efficient of mutual induction to a minimum, *i. e.*, so as to reduce to a minimum the flow of force passing through it. If we place in this alternating field a series of elementary bobbins, movable round a common axis, and if a system of brushes, suitably arranged, short circuits each of the bobbins at the moment when the flow passing through it is at its minimum, and opens the circuit when the flow becomes *nil*, leaving it open until the flow reaches its maximum again, each of these bobbins will be subjected to a force, and will, consequently, produce a motive torque, which the multiplicity of bobbins renders to all intents constant. In this motor there is no connection between the inductive circuit and the armature. The inductive circuit is metallically closed on the wires coming from the generator; the induced circuit is closed upon itself. The experiment can easily be made with a small Gramme or Rechniewsky machine of two poles, care being taken to loosen the brushes to the extent of about 45 degrees in the direction of the rotation. Alternating field motors are little used, and up to the present no experiments indicating their efficiency have been published.

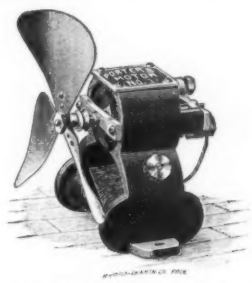
C. Motors with a revolving field.—In March, 1888, M. Ferraris indicated for the first time the principle of alternating current motors, the present development of which leads us to foresee within a short time a complete revolution both in the transport of powerful motive forces to great distances and in the distribution of electrical energy for motors of low power. This is the principle established by M. Ferraris: When two alternating currents of the same period, but with a lag of a quarter of a period, pass through two circuits arranged in a rectangular form, the resultant of each of the two magnetic fields which would be produced by each circuit if it acted alone is a revolving magnetic field of constant intensity and uniform angular speed, making a complete revolution in one period. If we place in this revolving field a circuit closed upon itself, it will be the seat of induced currents, and these induced currents will tend to make the induced circuit turn in the same direction as the field. With the exception of the mode of production of the revolving field, the rotation thus obtained is similar to that of the experiment known by the name of Arago's magnetism of rotation.

We may also say, and more correctly, that the motor with a revolving field works in virtue of the Foucault currents, of which it is the seat. These Foucault currents would be *nil* if the circuit maintained the same position in the field, *i.e.*, if the circuit turned at the same angular speed as the field, and it is in order to satisfy this condition of relative immobility that the circuit turns in the field and in the same direction the circuit *follows* the field.

Although a comparatively recent invention, the motors with a revolving field are already very varied as regards principle and arrangement. They are distinguished chiefly by the mode in which the revolving field is produced and by the generator which feeds the motor. We will examine first the ordinary alternating current motors, and then the motors fed by alternators with multiple phases, producing many phased currents.

a. Ordinary alternators.—There are several methods which will enable us to obtain, with an ordinary alternating current, two alternating currents with a lag of a quarter of a period, capable, consequently, of producing a revolving field.

M. Ferraris has proposed to employ two circuits, the first being fed directly by the alternator, and the second by the secondary



PORTER ELECTRIC MOTOR.—(See page 32.)

circuit of a transformer, the primary circuit of which is connected in derivation with the alternator. M. Tesla has proposed and employed two circuits in derivation presenting very different constants of time. M. Schallenberger arranges an induced circuit closed upon itself and placed obliquely with regard to the primary circuit fed by the alternator. In Messrs. Hutin and Leblanc's motor, which was presented at our last sitting, the revolving field is produced by two series of bobbins connected in derivation, but with a condenser introduced into one of the circuits. Thus the lag of a quarter of a period which is necessary for the production of the revolving field is very easily obtained.

b. Alternators with multiple phases, or with many phased currents.—The apparatus described are suited to the distribution of motive force and to the feeding of motors of moderate or low power. For the transport of high powers, it is preferable to employ special generators producing, not an ordinary alternating current, but several alternating currents lagging for the fraction of a period required, *i.e., polyphased* alternating currents.

We may employ, as the simplest solution of the problem, *two* currents conveyed by four wires, or three wires only if a common return wire be used. Arrangements of this kind have been suggested by Messrs. Ferraris and Tesla. Assuming that it is necessary to use three wires, it is preferable to employ them in the production of *three* currents of equal periods, but with a lag of a third of a period, profiting by the fact that for three currents lagging in this manner the algebraic sum of the intensities is always *nil*, each wire serving as a return wire for the currents

MR. M. J. SULLIVAN,
OF THE EDISON GENERAL ELECTRIC COMPANY.

passing through the other two circuits at the same instant. This is the principle of motors with polyphased currents, realized less than two years ago by Messrs. Dolivo-Dobrowolsky, Hazelwander, Bradley and Wenström. The transport of a motive force of 300 horse-power, based on currents of this nature and now in course of preparation between Lauffen and Frankfort-on-the Main, a distance of 175 kilometers, will be effected by means of three-phased currents generated at low tension, and transformed at high tension (20,000 to 30,000 volts) by insulated petroleum transformers constructed specially for the purpose by Mr. Brown. On their arrival, these currents will be again transformed into currents of low tension by a transformer similar to the first, and finally sent into a motor with a revolving field and three-phased currents.

The special interest of these experiments, the results of which are awaited with impatient curiosity, lies in the expectation of being able to state definitely that alternating currents are better suited than continuous currents to the production, transformation and canalization of electrical power represented by high potentials and low intensities. The motors with revolving field are, moreover, apparatus with metallically closed circuits, and are consequently not capable of giving rise to any extra current sparks or any dangerous breakage, the only interruption necessary being that of the commutator used for starting or stopping the machine, and, in this case, every precaution can be taken to obviate all danger.

This brief enumeration of the methods employed or proposed for the convenient and economical transformation of the electrical energy of alternating currents into mechanical work shows that we may now consider the problem solved. The same will, no doubt, soon be able to be said of the utilization of alternating currents for electro-chemical operations in which electrolysis and the storage of electrical energy play a part; the industrial importance of alternating currents will then be much greater than that of continuous currents and we shall witness a new evolution of electrical processes, while awaiting that reserved for us by alternating currents of very high frequency.

NEWSPAPER ADVERTISING.

EIGHTH OF A SERIES OF ARTICLES ON THIS IMPORTANT BRANCH.

The eighth of our series of advertising articles is from the pen of Mr. M. J. Sullivan, of the Edison General Electric Company. Mr. Sullivan's contribution will be found to be full of apt *similes* and contains many points that advertisers will appreciate:

MR. SULLIVAN'S INTERESTING VIEWS ON ADVERTISING.

TO THE EDITOR OF ELECTRICAL REVIEW:

Advertising is a subject, the why and wherefore of which is so limitless and uncertain that I dread to risk my pen to paper, lest I jar against what others have established as their code, or (what is more to be avoided) give birth to some new idea that cannot receive baptism at the hands of other advertisers.

So much can be said in favor of advertising, and so very much more against it, that we have yet to discover the genius who can formulate a set of rules by which a man can take a dollar from his pocket, plant it in printers' ink, and a short while thereafter come around and pick off a crop of new dollars. Some people have sown pennies broadcast, every one of which has sprung up and yielded fruit a hundred fold. Still others have selected their ground and planted their good dollars with the greatest care, to no other purpose than to rear tall, lanky, fruitless stalks in the shape of bills.

Were I interrogated before some tribunal which must know the truth as to whether advertising pays, I would answer "Yes." If given a chance to catch my breath I would immediately add, "and No."

Advertising pays when three factors are present—when there is a demand for the article advertised, when the advertising medium is of such a nature that the "Ad." will worm itself into focus with the public eye, and when the imprint of integrity is plainly written on the advertisement. These are conditions I firmly believe should be present before good money is risked on the presumption that to "advertise" is sufficient.

I have always maintained that every line of printers' ink forms part of the great cob-web which arrests the attention; but it is only the strong, well spun and perfectly fitted threads that will hold the mind captive long enough to enable an opinion to form. To feel the people's pulse, and prepare lotions which the people want, is indeed the work of a master; but how often do such attempts fail?

I have known intelligent men who have read their newspaper for years without noticing certain advertisements. On the other hand, some clever cut or word will do the business in a single issue.

In large manufacturing industries the best possible mediums may be found among what are known as "trade journals." Published solely in the interest of their respective branches of industry, these publications are read and digested by those actively engaged in the business which affords a market for the advertised product. The regular spaces are always examined for "new things." News items are assured to the advertiser, and he has good reason to believe that the paper is his friend. But even these must be carefully selected. Penetrating the dark secrets of Africa is not a marker to plunging into the mystery which surrounds the "circulation" of nearly every publication, and it is in selecting these mediums and keeping the reading columns warm that life loses all its charms.

To conclude, I would say that, properly handled, the money expended in advertising is the best kind of an investment. In the proportion that a man proclaims himself before the people, in just that proportion will he become known, and being known above others, it is only reasonable that he will receive attention.

M. J. Sullivan

New York, September 1, 1891.

KINDRED INTERESTS

The Page Belting Company, of Concord, N. H., has just turned out the largest belt ever made in that part of the country. It was ordered for the Reading Electric Light and Power Company, of Reading, Pa., and is 58 inches wide, 127 feet long and nearly one-half an inch thick; 140 ox hides were used in its construction.

The Electric Merchandise Company some time since issued a very large and complete catalogue that they supposed covered the entire field. But having lately placed on the market considerable new line material of peculiar merit, they have found it necessary to issue a supplement, a copy of which has been received by the REVIEW. Copies may be had on application to the company at Chicago.

The Standard Underground Cable Company will have an unusually handsome exhibit at the Montreal Electric Light Convention. Among other things, it will consist of a double set of the company's initials done in brass, supporting samples of underground cables for all classes of electric service. It will contain also a special sample board of samples of all kinds and sizes of cables to be used in the contract of the Minnesota Brush Electric Light and Power Company, of Minneapolis, just awarded the Standard Company, and which covers over 400,000 feet of underground cable, making it the largest single contract of its kind ever given in the United States. Vice-president J. W. Marsh, of Pittsburgh, and Manager G. L. Wiley, of New York, will represent the company at the Convention.

The Interior Conduit and Insulation Company, of New York, will be ably represented at the coming convention in Montreal by its president, Mr. Edward H. Johnson; general manager, E. W. Little, and E. T. Greenfield, electrician. This being the first opportunity presented since their embarkation in the general electrical manufacturing business to make an exhibit of their new appliances and apparatus, it is promised that many novel devices will be shown. Prominent among these will be the Johnson ampere meter and the Johnson vice lock switch, recent tests upon the first models of which have proved very satisfactory. The company will also show the new California arc lamp, which they are about to place on the market, and this, with the Garland carbon protector, another new device, will be worthy of special attention by those visiting the exhibition.

Improvements in Gas Engines.

The recent improvements in gas engines and their growing popularity as a motive power for dynamos has already brought them into prominence among electric light men, and especially where small but even and reliable power forms an essential feature.

Among the engines of this type which are now recommending themselves favorably to power users the Rollason gas engine, illustrations of which will be found on another page, occupies a prominent position. These engines possess features which are claimed to make them superior to anything which have yet been put on the market. They are entirely automatic in their movement and run economically at speeds varying from 150 to 280 revolutions per minute, and work with a dilute or strong mixture of gas and air, according to the load or requirements of the work.

These engines have been on the English market about two years, and their success there has led to the manufacture of them in this country by the Electric Manufacturing and Gas Engine Company, at Greenbush, N. Y., under United States letters patent of Messrs. Rollason & Hamilton, of England, who have had wide experience in this class of work.

LITTLE GIANT.
R. I. Telephone & Electric Co.,
Providence, R. I.

IF YOU have anything pertaining to electric machinery you want to sell, send us the description.
IF YOU want anything pertaining to electric machinery, send us your inquiries.
FRANK RIDLON & CO.,
Dealers in New and Second-Hand
Electric Light & Power Machinery,
196 SUMMER STREET, BOSTON.

MACHINERY IN STOCK.

Engine Lathes, 10 in. x 4 ft.; 11 in. x 5 ft.; 12 in. x 6 ft.; 14 in. x 6 ft.; 16 in. x 6 ft.; 18 in. x 8 ft.; 20 in. x 8 ft., with tapes attachment; 22 in. x 12 ft. and 14 ft.; 24 in. and 26 in. x 16 ft.; 30 in. x 10 ft. and 18 ft.; 36 in. and 38 in. x 20 ft.; 42 in. x 12 ft.; 56 in. x 18 ft.; 72 in. x 20 ft.; 108 in. x 22 ft. Fox Lathes, 13 in. x 5 ft.; 14 in. x 5 ft.; 15 in. x 6 ft.; 18 in. x 6 ft. Turret Lathes, 12 in. x 5 ft.; 14 in. x 5 ft.; 15 in. and 16 in. x 6 ft.; 18 in. x 6 ft.; 36 in. x 8 ft.
Planers, 16 in. x 16 in. x 3 ft.; 20 in. x 20 in. x 4 ft.; 24 in. x 24 in. x 6 ft.; 30 in. x 30 in. x 6 ft.; 36 in. x 36 in. x 10 ft.; 42 in. x 42 in. x 12 ft.; 72 in. x 60 in. x 15 ft.; 72 in. x 60 in. x 20 ft.
Friction Shapers, 15 in., 16 in., 20 in., 22 in., 32 in.
Crank Shapers, 6 in., 8 in., 10 in., 12 in., 15 in., 16 in., 20 in., 24 in., 28 in.
Screw Machines, Nos. 1, 2, 3, 4, with or without Wire Feed.
Screw Machines, Nos. 5, 6, 7, 8, Power Feed.
Presses, Nos. 51, 52, 53, Ferracute, Nos. 1, 2, 3, Stiles & Parker.
20 Lincoln Pattern Millers, No. 2.
Hand Millers, Nos. 1 and 2. 3 Cam Cutters.
Bolt Cutters, ¼ in. to 1 in., ¼ in. to 2 in.
2 Profiling Machines. 1 36 in. and 48 in. Gear Cutter.
1 New Horizontal Boring Machine. Newark Machine Tool Co.
Send for List of New and Second-Hand Machinery in Stock.
PRENTISS TOOL & SUPPLY CO., P. O. Box 3362.
115 Liberty Street, New York.

Burnley Dry Battery
PATENTED JAN., 1890.

STRONGER than any Open Circuit Battery on the Market.
BETTER than any other Dry Battery yet produced.
Most compact in size and cheapest. 90 cents per cell.
Discount to the Trade and in quantities.
J. H. BUNNELL & CO.,
Sole Manufacturers and General Agents,
76 CORTLANDT ST., N. Y.

THE LAW
Double Cylinder Battery.

Surface of negative element and quantity of solution double that found in any other open circuit cell.
Weigh carefully these advantages.

Its sale has steadily increased for ten years.
LAW TELEPHONE CO.,
Sole Makers,
87 JOHN STREET, NEW YORK.

HJALMAR LOFQUIST,
Electrical Engineer, Stockholm, Sweden.
Office for Import and Export of Electrical Appliances. Best medium for introducing news in Electric Light, Power and Heating.

THE REMINGTON
STANDARD
TYPEWRITER

Is to-day, as it has ever been, the leading Typewriter.
Carefully tested improvements are constantly added to this famous machine.

Send for Illustrated Catalogue.

Try Our Paragon Brand of Typewriter Ribbons
Wyckoff, Seamans & Benedict.
327 Broadway, New York.

FOR ADVERTISEMENT
—: OF :—
Chas. A. Schieren & Co.,
SEE PAGE XI.

THE ELECTRICAL ENGINEERING COMPANY,
Contractors for Complete Arc, Incandescent and ower Plants.
ROOM 603, MONON BLOCK, 320 DEARBORN ST., CHICAGO, ILL.
Superintending Electrical Construction, and Advice on Electrical and Mechanical Subjects a Specialty.

Standard Electrical Measuring Instruments.
We make a great variety of Testing Instruments, such as Ammeters, Voltmeters, Galvanometers, Resistance Boxes, Photometers—in fact, everything that an electrician requires in making measurements of current, E. M. F., resistance, insulation, efficiency, etc.
Correspond with us before placing your orders, and send for our illustrated catalogue No. 1-66.
QUEEN & CO., Makers, Philadelphia.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON SEPTEMBER 1, 1891.

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458,585 Telegraphy; David Kunhardt, Aachen, Germany.
458,587 Electric brake; John C. Lincoln, Rochester, N. Y.
458,603 Fusible cut-out; Charles S. Van Nuis, New Brunswick, N. J., and Jonathan H. Vail, New York, N. Y.
458,617 Regulator for constant current dynamos.
458,618 Constant current dynamo; Ernest P. Clark, New York, N. Y., assignor to the Clark Electric Co., same place.
458,619 Conduit for electric railways. 458,620 Electric trolley or contact wheel; Frederick E. Degenhardt, Chicago, Ill.
458,625 Electro-therapeutic apparatus; William J. Hardman, Ann Arbor, Mich.
458,630 Conduit for electric railway; Emil E. Keller, Chicago, Ill.
458,646 Electric motor; Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Co. of Connecticut.
458,652 Electro-chemical transformer. 458,653 Incandescent lamp socket; Turner D. Bottome, Hoosick, N. Y.
458,656 Lightning arrester; James P. Freeman, Washington, D. C., assignor of two-thirds to Marvin C. Stone and Philip T. Dodge, same place.
458,665 Electric railway; Henry A. Seymour, Washington, D. C., assignor to the Short Electric Railway Co., Cleveland, O.
458,666 Automatic cut-out for dynamo-electric machines. 458,956 Controlling dynamo-electric machines for electric railways; Sidney H. Short, Cleveland, O., assignor to the Short Electric Railway Co., same place.
458,702 Electric generator; John C. Henderson, New York, and Frederick Sargent, New Rochelle, assignors to the Edison General Electric Co., New York, N. Y.
458,718 Carbon clamp for electric arc lamps; Albert P. Seymour, Syracuse, N. Y.
458,719 Duplex arc lamp; Barton B. Ward, New York, N. Y.
458,729 Electric locomotor; Henry F. Shaw, Boston, and George F. Shaw, Dedham, Mass., assignors to Franklin L. Pope, New York, N. Y.
458,753 Protective fuse; Hammond V. Hayes, Cambridge, and Anthony C. White, Boston, assignors to the American Bell Telephone Co., Boston, Mass.
458,755 Electric meter; Maurice Koechlin, Belport, France.
458,769 Electric light fixture; Fred. H. Aldrich, Cadillac, Mich.
458,778 Electric subway; John C. Reilly, Brooklyn, N. Y.
458,785 Self-lubricating electric trolley; Timothy Driscoll, Minneapolis, Minn., assignor of one-half to Geo. L. Hunt, same place.
458,800 Electric car mechanism; William E. Badger, West Quincy, Mass.
458,844 Electric railway; Leon O. Dion, Natick, Mass.
458,856 Armature for electric motors or generators; James F. McLaughlin, Philadelphia, Pa.
458,859 Method of and apparatus for operating electric railways by dynamic induction; Elias E. Ries, Baltimore, Md., assignor to Ries & Henderson, same place.
458,866 Closed conduit for electric railways; Charles J. Van Depoele, Chicago, Ill.
458,867 System of electric railway conductors. 458,868 Electric coal-mining machine. 458,869 Circuit controller for electro-magnetic engines. 458,870 System of supplying current to reciprocating electric engines. 458,871 Telpher system. 458,872 Electro-magnetic reciprocating engine. 458,873 Combined electric engine and pump. 458,874 Reciprocating electric engine. 458,954 System of reciprocating electric engines; Charles J. Van Depoele, Lynn, Mass.
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458,931 458,932 Electric Railway; Walter C. Wright. Philadelphia, Pa.
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OFFICE OF THE LIGHT-HOUSE INSPECTOR, THIRD DISTRICT.
TOMPKINSVILLE, NEW YORK, P. O. BOX, 2128, NEW YORK CITY, August 31, 1891.

Proposals will be received at this office until 2 o'clock P. M. on Wednesday, September 16, 1891, for supplying 17,000 feet, more or less, of three conductor double-armor electric cable about two inches in diameter, needed for lighting buoys to mark Gedney Channel, New York Bay. Full information relative to this cable can be obtained on application at this office. The right is reserved to reject any or all bids and to waive any defects.
HENRY F. PICKING, U. S. N.,
Light-House Inspector.

BINDER FOR REVIEW
Will be sent to any address, postage prepaid, on receipt of 30 cents.
ELECTRICAL REVIEW,
13 PARK ROW, NEW YORK.

KINDRED INTERESTS

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R. I. Telephone & Electric Co.,
Providence, R. I.

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IF YOU want anything pertaining to electric machinery, send us your inquiries.
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1 New Horizontal Boring Machine. Newark Machine Tool Co.
Send for List of New and Second-Hand Machinery in Stock.
PRENTISS TOOL & SUPPLY CO., P. O. Box 3362.
115 Liberty Street, New York.

Burnley Dry Battery
PATENTED JAN., 1890.

STRONGER than any Open Circuit Battery on the Market.
BETTER than any other Dry Battery yet produced.
Most compact in size and cheapest. 90 cents per cell.
Discount to the Trade and in quantities.

J. H. BUNNELL & CO.,
Sole Manufacturers and General Agents,
76 CORTLANDT ST., N. Y.

THE LAW
Double Cylinder Battery.

Surface of negative element and quantity of solution double that found in any other open circuit cell.
Weigh carefully these advantages.

Its sale has steadily increased for ten years.

LAW TELEPHONE CO.,
Sole Makers,
87 JOHN STREET, NEW YORK.

HJALMAR LOFGUIST,
Electrical Engineer, Stockholm, Sweden.
Office for Import and Export of Electrical Appliances. Best medium for introducing news in Electric Light, Power and Heating.

THE REMINGTON
STANDARD
TYPEWRITER

Is to-day, as it has ever been, the leading Typewriter.
Carefully tested improvements are constantly added to this famous machine.
Send for Illustrated Catalogue.

Try Our Paragon Brand of Typewriter Ribbons

Wyckoff, Seamans & Benedict.
327 Broadway, New York.

FOR ADVERTISEMENT
—: OF :—
Chas. A. Schieren & Co.,
SEE PAGE XI.

THE ELECTRICAL ENGINEERING COMPANY,
Contractors for Complete Arc, Incandescent and over Plants.
ROOM 603, MONON BLOCK, 320 DEARBORN ST., CHICAGO, ILL.
Superintending Electrical Construction, and Advice on Electrical and Mechanical Subjects a Specialty.

Standard Electrical Measuring Instruments.
We make a great variety of Testing Instruments, such as Ammeters, Voltmeters, Galvanometers, Resistance Boxes, Photometers—in fact, everything that an electrician requires in making measurements of current, E. M. F., resistance, insulation, efficiency, etc.
Correspond with us before placing your orders, and send for our illustrated catalogue No. 1-66.
QUEEN & CO., Makers, Philadelphia.

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HENRY F. PICKING, U. S. N.,
Light-House Inspector.

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ELECTRICAL REVIEW,
13 PARK ROW, NEW YORK.